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UNIVERSITY OF CALIFORNIA
DEPARTMENT OF EDUCATION

BUREAU OF RESEARCH IN EDUCATION STUDY NO. 1

MEASURING CLASSROOM PRODUCTS IN BERKELEY

Sections 1 and 2

DIRECTED BY
CYRUS D. MEAD
Associate Professor of Elementary Education

MAY 1, 1921
PRICE 50 CENTS

UNIVERSITY OF CALIFORNIA
DEPARTMENT OF EDUCATION

MEASURING CLASSROOM PRODUCTS IN BERKELEY

Study Number 1
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In two Sections—Section I

Tread, Byron P. [illegible]

DECEMBER 1, 1920

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MEASURING CLASSROOM PRODUCTS IN BERKELEY

Cyrus D. Mead
Associate Professor of Elementary Education
University of California

Assisted by Educational Measurements Seminar:

Jeanette Barrows, Alex. S. Boulware, Bert B. Davis, William F. Ewing, Harry H. Glessner, A. J. Hamilton, Geo. C. Kyte, Norma E. LeVeque, Louis P. Linn, Anna O'Bannon, Mary B. O'Bannon, Clara M. Partridge.

Foreword and Introduction
by
H. B. Wilson
Superintendent of Schools

CONTENTS

PAGE

Foreword and Introduction by Superintendent Wilson 5
Request for the Survey 5
Letter of Transmittal 7

Section I

Chapter 1.—Report of the Seminar Committee on Writing 10
Directions for Giving the Handwriting Tests 10
Oral Instructions Concerning 11
Scoring the Papers 11
Uniformity of Judgments as to Quality 12
Tabulation of Results 13
Interpretation of Data 17
Comparison of Schools 23
Bibliography 33

Chapter 2.—Report of the Seminar Committee on Spelling 34
Material for the Test and Plan of Giving 34
Instructions for Giving 34
Oral Instructions 35
Tabulation of Results 35
Factors to be Considered in Interpretation of Results 37
Interpretation of Results 40
Recommendations for Teaching Spelling 42

FOREWORD AND INTRODUCTION

Any program of administration or management which is concerned with securing efficient results with justifiable economy must be based upon reliable facts. This is quite as true in the fields of finance and industry as in educational institutions. Every up to date, progressive business institution has its Department of Efficiency, to which it looks for scientific evaluation of its efforts. Upon the basis of these findings it modifies its programs of operation and procedure from time to time.

Realizing the need of definite information as to what was being accomplished in the public schools of Berkeley, and being without a Department of Research at that time, I sought the coöperation of the Department of Education at the University of California. I found Dean Alexis F. Lange and his associates in the department immediately interested to render service and to avail themselves of the laboratory opportunity thus provided. Accordingly, following two or three conferences, I was able to report to the Board of Education at the regular meeting of October 1, 1918, that tentative arrangements had been made with the faculty of the Education Department of the University of California for the direction by Dr. Cyrus D. Mead, Associate Professor of Elementary Education, of available graduate students in such research work in the public schools of Berkeley as would enable the determination of the results which were being secured in the public schools in the various grades and in the various subjects which might be investigated. The board readily approved the arrangements made by the superintendent, and empowered him to act fully in the matter and to print the results of the study for distribution when they were completed.

The results of this coöperative arrangement have been very satisfactory, indeed, as the published results in the following pages show. Scientific studies were conducted to determine the results which were being secured in Writing, Spelling, Reading, the Fundamentals of Arithmetic, and Reasoning Ability in Arithmetic. Before the second section is ready for publication, it is hoped that it may be possible to add an appendix dealing briefly with the results which are being secured in Composition and Geography.

The value to a school system of such an investigation as this is perhaps three-fold. It is an immediate help to the teacher in diagnosing the difficulties and problems which are confronting her and in enabling

her to find ways and means of solving the same. Second, it provides certain valuable training facilities for these teachers who wish to familiarize themselves with the technique of scientific investigation. Third, it provides accurate, reliable data gathered by scientific methods for the use of the administrative and supervisor force in enabling them to study conditions throughout the system and to make comparisons with other systems. It constitutes the necessary basis for readjusting the emphasis that should be given to different topics and subjects, and for modifying and improving the teaching technique in the interest of better results.

For the service rendered the public schools through this coöperative effort, we are genuinely thankful to the Department of Education of the University of California. It is believed that the publication of these results is desirable not only because of their value to the public schools of Berkeley, but because the methods used and the results indicated will be of interest and service to others.

H. B. Wilson,
Superintendent of Schools,
Berkeley, California.

DEPARTMENT OF EDUCATION
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA

LETTER OF TRANSMITTAL

DR. H. B. WILSON,
Superintendent of Schools,
Berkeley, California.

May 28, 1919.

My Dear Dr. Wilson:

In pursuance with your request in September 1918, the members of my Seminar in The Measurement of Elementary School Work undertook as a project a survey of the Berkeley Schools, such survey on their part to include the application of standard tests to the subject matter of the elementary field. The class of men and women in Education gladly accepted this work with the resolution that the teachers of the system as a whole should become an integral part and assist in such survey and that, whatever the findings, there should be included in the report constructive helps and suggestions for the further improvement of teaching in our city schools. We were extremely fortunate in having, as well as graduate students in Education, a number of your progressive principals and teachers. It has given me much pleasure, with no little pride, to watch the growing interest and enthusiasm of this seminar group. They have applied themselves to the work with a zeal and professional spirit which I wish to commend to you. The extension of the class period from two to three hours weekly was but a trifle to the additional hours of work put in throughout the school year. They have done a most careful and thorough piece of work.

It was decided to measure the school products from the second or third grades to the eighth or ninth inclusive in handwriting, spelling, reading, the fundamentals of arithmetic and arithmetical reasoning.[1] The following standard tests were applied or made use of:

Handwriting—AYRES: Gettysburg Scale.
Spelling —AYRES: Measuring Scale for Ability in Spelling.
Reading —MONROE: Standardized Silent Reading Tests.
Arithmetic —COURTIS: Series B Standard Research Tests (Fundamentals).
STARCH: Arithmetical Scale A (Reasoning).

[1] The studies in English Composition and Geography, which are to appear in the Appendix of Section II of the report were made by the 1920–21 Educational Measurements Seminar.

The method of procedure was to study the scales and tests, their derivation, use and applications that had been made. Accompanying this the technique of the statistical method was studied and practiced. A preliminary meeting was held the week or two preceding the giving of each test in which the plan was outlined and the directions carefully formulated. These directions were mimeographed by your office force and mailed to each principal and teacher. Within the day or two following, each seminar student appeared at his group of schools, usually two, in order to meet the teachers in group and explain in detail the giving of the tests. Each test was administered under the direction of the seminar representative but was given by the class teacher. In most instances the marking of the papers was by the teacher. In all cases, however, these gradings were checked and verified by seminar groups. This was tedious work but for uniformity and purposes of comparison it was found necessary. The teachers were most conscientious in their markings but in some instances it was found that there were variations in judgment even when the form of the answer seemed to be explicit.

Practically every pupil in the system participated. All classes were included, there was no selection. This is unusual in that most surveys have made random selections of pupils. In all, we measured from five to six thousand children in each of the tests. This involved the handling of about twenty-five thousand papers. We wish to commend your office force for the efficient assistance they rendered and for the excellent mimeographed forms they supplied for recording our data.

The entire seminar took part in scoring the handwriting samples and in checking and verifying the scores on the various test sheets. Particular subjects however were assigned committees to assemble the data in tabular and graphic form and to make constructive suggestions. The following is a list of committees:

Handwriting—Alex S. Boulware, Supervisor of Penmanship, San Francisco State Normal School, San Francisco.
William F. Ewing, Vice Principal, Oakland Technical High School, Oakland.
A. J. Hamilton, Principal, Washington School, Berkeley.
George C. Kyte, Principal, Emerson School, Berkeley.

Spelling —Mrs. Clara M. Partridge, Principal, Oxford School, Berkeley.
Jeannette Barrows, Principal, Hillside School, Berkeley.
Norma E. LeVeque, Graduate Student, Boulder, Colorado.

Reading —Harry H. Glessner, Principal Edison (Junior High) School, Berkeley.
Bert B. Davis, Normal Director, Walla Walla College, College Place, Washington.
(Mrs. Partridge and Miss Barrows assisting).

Arithmetic (Fundamentals)—

Louis P. Linn, Instructor in Educational Extension, University of California.
Mary B. O'Bannon. Principal of Jefferson School, Berkeley.
Anna O'Bannon, Teacher of Mathematics, McKinley School, Berkeley.

Arithmetic (Reasoning)—

(Misses Anna and Mary O'Bannon and Miss Barrows).

The Seminar also wishes to express its appreciation of the help rendered by the principals and teachers of the system. It was felt that the professional improvement resulting from the teaching force taking a direct hand would more than offset any possible variations in the giving of the tests.

Very truly yours,

Cyrus D. Mead,
Associate Professor of Elementary Education,
University of California.

CHAPTER I

REPORT OF THE COMMITTEE ON HANDWRITING

The first test to be given the children of the Berkeley Schools in the present survey was the test in handwriting. In order to determine the speed and quality of the handwriting of the children it was necessary to obtain samples of a uniform nature produced under conditions as nearly uniform as possible. Since the Gettysburg Edition of the Ayres Handwriting Scale was to be used as a basis for judging the quality of the samples of handwriting, it was deemed wise to use the opening sentences of the Gettysburg Speech as the material for the test.

The following instructions in regard to the test were sent out from the Superintendent's office:

THE PUBLIC SCHOOLS
BERKELEY, CALIFORNIA

BULLETIN NO. 24,
December 10, 1918.

DIRECTIONS FOR GIVING HANDWRITING TESTS

To Principals and Teachers:

On Thursday, December 12th, or Friday the 13th, it is desired to secure samples of handwriting from all the pupils in grades two to nine inclusive. A representative of Dr. Mead's Seminar will come to your school on Thursday to assist you in any way. The samples of handwriting should be secured in the following manner:

Each teacher should write on the board in the front of the room, (and the sides also, if desirable), the first three sentences of Lincoln's Gettysburg Address. As a preliminary preparation, the pupils should read and copy this until they are thoroughly familiar with it and practically know it by heart. For the final test, preparations should be made so that all the pupils can begin to copy, and stop, at a given signal. They should be allowed to write for precisely two minutes. Care should be taken with these conditions. It is not likely that any pupil will be able to copy the entire three sentences in the two minutes allowed. See that the papers for each grade are fastened together. They will be scored for both speed and quality.

The writing should be in ink and on ruled paper. Second or third grade pupils may use pencil if not accustomed to ink. Before the test begins, have each pupil write his name, grade, name of school and date on the reverse side of the paper. The teacher should mark in the upper right-hand corner of each the number of letters written by the pupil in the two minutes. The following count of letters will aid in scoring the papers:

Fourscore 9 and 12 seven 17 years 22 ago 25 our 28 fathers 35 brought 42 forth 47 upon 51 this 55 continent 64 a 65 new 68 nation 74 conceived 83 in 85 liberty 92 and 95 dedicated 104 to 106 the 109 proposition 120 that 124 all 127 men 130 are 133 created 140 equal 145.

Now 148 we 150 are 153 engaged 160 in 162 a 163 great 168 civil 173 war 176 testing 183 whether 190 that 194 nation 200 or 202 any 205 nation 211 so 213 conceived 222 and 225 so 227 dedicated 236 can 239 long 243 endure 249. We 251 are 254 met 257 on 259 a 260 great 265 battlefield 276 of 278 that 282 war 285.

Kindly follow the above directions slavishly and absolutely, that there may be no factor entering into the securing of these writing specimens which would render the results impossible to use. These will reach you Wednesday, the day before the representative from Dr. Mead's Seminar expects to visit you. Any question of any character or any detail of procedure should be taken up with this representative at the time of the visit.

Very truly,

H. B. Wilson,
Superintendent of Schools.

Oral Instructions Concerning the Test

Before the test was given members of the Seminar conducting the survey met the teachers of the several schools and explained in detail the technique of giving the test and handling the papers. Especial attention was called to the necessity of measuring accurately the two-minute period which was allowed for the test. So far as can be seen from the pupils' papers, the test was carried out in every way as planned. In many cases children stopped in the middle of a word and often the final letters were left unfinished.

Scoring the Papers

By far the greatest task in connection with this survey of the Berkeley Schools was the problem of training the members of the Seminar in the use of the handwriting scale. Before any of the samples of handwriting written by the Berkeley children could be evaluated for quality

it was necessary to develop a consistency in the use of the scale which would be trustworthy. From the very beginning it was apparent that the judgments of the members of the Seminar in regard to quality values must be standardized before the actual problem of rating the test samples could be undertaken. It was desired that all members of the Seminar participate in this activity so that the final judgments of quality should be a composite judgment rather than a personal judgment as has been the case in most of the surveys of handwriting so far conducted.

Only a few of the members had previously had any experience with work of this character and the results of the first round of practice showed a wide range of values assigned to individual papers. This was found to be true especially with regard to papers which were in any way strikingly different from the samples on the scale. A period of practice was, therefore, entered into which extended over some fifteen weeks, although but eight actual rounds of practice were found to be necessary. A brief statement of the outcome of this period of practice is here given since it is believed the findings of the survey in regard to quality of handwriting will be better appreciated when it is understood with what care these findings were determined.

Uniformity of Judgments as to Quality

After the members of the Seminar had practiced rating papers for several weeks it became apparent that certain members tended to rate high and others low. By careful selection of the rating groups these tendencies were so balanced that the composite judgment of the groups was consistent and uniform with that of the other rating groups. (There were twelve members divided into three groups of four each). The results of the last round of practice before the rating of the test papers was begun is summarized here to show how near to actual uniformity the judgments had become as a result of practice and discussion.

A set of twenty-five papers ranging in quality from very poor to very good was selected for practice. All members of the Seminar rated the papers. Composite judgments were determined for the three groups into which the Seminar had been divided as previously explained. The following table gives the comparison of these composite judgments with the true values:

	Group I	Group II	Group III
Absolute agreement with the true values	12	14	15
Variation of ½ step from the true values	11	11	7
Variation of 1 step from the true values	2	0	3
	25	25	25

When it is understood that a variation of one-half step from the actual value on the scale is considered by competent judges the country over to be of little consequence, it can be seen to what degree the practice work had been effectual in standardizing the evaluation of quality. Out of the seventy-five composite judgments only five were as much as one step away from the true value and no values were assigned showing a greater variation than one step. (The "true" value for each sample was determined by averaging the judgments of the twelve members independently of the rating groups. It is felt that these so-called "true values" would not have been changed so much as a quarter step had the papers been rated by a much larger group of competent judges, hence, there is no hesitancy in accepting them as real or true values.)

When the ability to determine quality of handwriting had been brought to a satisfactory standard the rating of the test papers of the Berkeley children was undertaken. The papers for each class in each school were so divided that a third of them were rated by each of the rating groups. The value assigned to each paper was the composite judgment of one rating group, but the average rating for the class was, after all, a composite of the judgments of the whole seminar.

Tabulation of Results

The following tables give the results of the handwriting test with regard to both speed and quality. A perusal of these tables, and especially of the graphs which accompany them, should prove interesting and helpful to all who are concerned with the educational progress of the children in the Berkeley schools. For the sake of comparison, certain standards of attainment have been placed beside the figures for Berkeley.* The figures for two other school systems have been included as a means of comparison—Richmond, California, and St. Louis, Missouri.

* The achievement in Berkeley Schools has been made under a prescribed weekly minimum time allotment as follows:

	Grade I	Grade II	Grade III	Grade IV	Grade V	Grade VI	Grade VII	Grade VIII
Min. per week	95	75	80	80	80	60	....	....

TABLE I

NUMBER OF PUPILS IN EACH GRADE AT EACH SPEED (LETTERS PER MINUTE)

BERKELEY ELEMENTARY AND INTERMEDIATE SCHOOLS

Speed	2B	2A	3B	3A	4B	4A	5B	5A	6B	6A	7B	7A	8B	8A	9B	9A	Total	Per cent
0–9	7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	.17
10	137	80	23	2	2	1	0	0	0	0	0	0	0	0	0	0	245	4.83
20	122	103	84	31	14	11	13	3	0	2	0	0	1	0	0	0	384	7.57
30	37	52	97	90	79	35	40	6	7	2	2	0	0	0	0	0	447	8.81
40	3	21	47	97	113	89	84	26	40	12	6	3	3	1	0	0	545	10.74
50		1	23	55	87	76	85	66	55	29	22	7	8	3	0	1	518	10.21
60		1	10	31	55	65	85	91	78	64	44	18	24	11	1	5	583	11.48
70		1	10	8	36	49	69	82	89	95	84	54	39	28	17	6	667	13.13
80			3	4	11	13	19	53	69	79	84	56	49	31	38	14	523	10.31
90			0	1	0	3	16	22	20	38	57	45	58	43	53	15	371	7.31
100			0		2	3	3	11	14	25	50	38	59	43	55	26	329	6.48
110			1				1	4	3	5	29	17	30	43	33	16	182	3.58
120							1		5	2	12	14	33	29	23	20	139	2.74
130										1	12	6	12	14	20	15	80	1.60
140											6	3	9	16	6	8	48	.94
150																4	4	.08
160																0	0	.00
170																1	1	.02
	306	261	298	319	399	345	416	364	380	354	408	261	325	262	246	131	5075	100.00

Table II

Number of Pupils in Each Grade at Each Quality

Berkeley Elementary and Intermediate Schools

Quality	2B	2A	3B	3A	4B	4A	5B	5A	6B	6A	7B	7A	8B	8A	9B	9A	Total	Per cent
10*	2	5	4	1	2	0	0	0	1	1	2	0	0	0	0	0	18	.35
20†	14	11	13	14	11	7	7	4	1	4	8	1	2	2	1	0	100	1.97
25	26	18	31	42	40	22	33	25	27	24	10	8	5	2	3	8	324	6.38
30	94	53	47	73	95	61	69	68	55	58	49	19	33	25	7	6	812	16.01
35	67	65	68	65	111	95	113	74	82	74	82	37	53	45	19	12	1062	20.93
40	77	75	65	62	94	70	94	85	95	66	100	69	75	75	43	26	1171	23.08
45	20	16	36	37	34	50	42	46	56	54	85	57	65	52	60	31	741	14.60
50	5	15	19	14	6	22	33	40	33	37	32	33	41	31	41	20	422	8.31
55	1	2	12	9	4	14	15	15	13	22	19	24	30	20	39	11	250	4.92
60		0	3	2	1	2	7	5	11	7	12	10	14	6	18	8	106	2.08
65		0			1	2	1	2	5	4	8	3	4	4	10	7	51	1.00
70		1					2		1	3	1		3		5	1	17	.35
75																1	1	.02
	306	261	298	319	399	345	416	364	380	354	408	261	325	262	246	131	5075	100.00

* Quality 10 denotes a quality of handwriting below 20, the lowest quality on the Ayres Scale; 10 represents 0—19.9 quality.

† Quality 20 represents qualities from 20 to 24.9.

TABLE III

MEASURES OF CENTRAL TENDENCY FOR THE BERKELEY SCHOOLS[1]

Speed

Grade	Average	Median	Lower Quartile	Upper Quartile	Quartile Range
2B	21.47	20.7	15.07	27.00	11.93
2A	25.46	24.7	17.9	32.07	14.17
3B	36.54	34.3	26.13	44.15	18.02
3A	45.12	43.7	35.20	53.50	18.30
4B	51.21	49.2	40.42	60.77	20.35
4A	55.95	54.8	44.41	67.19	22.78
5B	59.06	58.4	46.07	70.72	24.65
5A	69.67	68.9	58.48	79.87	21.39
6B	71.10	71.1	58.72	82.32	23.60
6A	77.54	77.2	66.80	87.78	20.98
7B	87.84	85.5	73.33	101.40	28.07
7A	90.86	88.7	76.90	103.33	26.43
8B	96.78	96.6	81.27	110.66	29.39
8A	103.21	103.3	87.26	118.49	31.23
9B	104.15	102.5	91.04	116.21	25.17
9A	110.65	109.4	94.50	127.62	33.12

[1] Derived from Table I.

TABLE IV

MEASURES OF CENTRAL TENDENCY FOR THE BERKELEY SCHOOLS[1]

Quality

Grade	Average	Median	Lower Quartile	Upper Quartile	Quartile Range
2B	36.27	38.8	31.83	41.72	9.89
2A	37.98	38.3	32.94	42.91	9.97
3B	39.06	39.0	32.82	44.65	11.83
3A	37.83	37.3	31.55	43.57	12.02
4B	37.16	37.3	32.46	42.14	9.68
4A	40.22	39.3	34.69	48.75	14.06
5B	40.33	39.4	34.64	44.78	10.14
5A	41.13	40.6	34.56	46.85	12.29
6B	41.89	41.2	35.67	47.14	11.47
6A	42.18	41.2	35.88	48.56	12.68
7B	43.09	42.7	37.01	48.23	11.21
7A	45.31	44.7	40.02	50.72	10.70
8B	45.41	44.6	38.89	51.31	12.42
8A	44.58	43.8	39.05	49.56	10.51
9B	49.91	49.1	43.66	56.35	12.69
9A	47.69	47.2	41.30	53.81	12.51

[1] Derived from Table II.

TABLE V

AVERAGE SCORES IN SPEED BY GRADES

Comparative Tables

Grade	Berkeley	*St. Louis	†Richmond	‡Ayres Standard
2	25.5	36.7	.....	31
3	45.1	56.8	39.2	44
4	56.0	64.0	48.4	55
5	69.7	65.6	67.2	64
6	77.6	69.3	80.1	71
7	90.9	74.7	82.8	76
8	103.2	72.8	94.6	79
9	110.6	.....	.....	....

* See No. 8 in Selected Bibliography on Handwriting which is appended to this report.

† Data from an unpublished study made by A. S. Boulware, Geo. C. Kyte, and A. J. Hamilton (1919).

‡ See No. 3 in Selected Bibliography.

TABLE VI

AVERAGE SCORES IN QUALITY BY GRADES

*Comparative Tables**

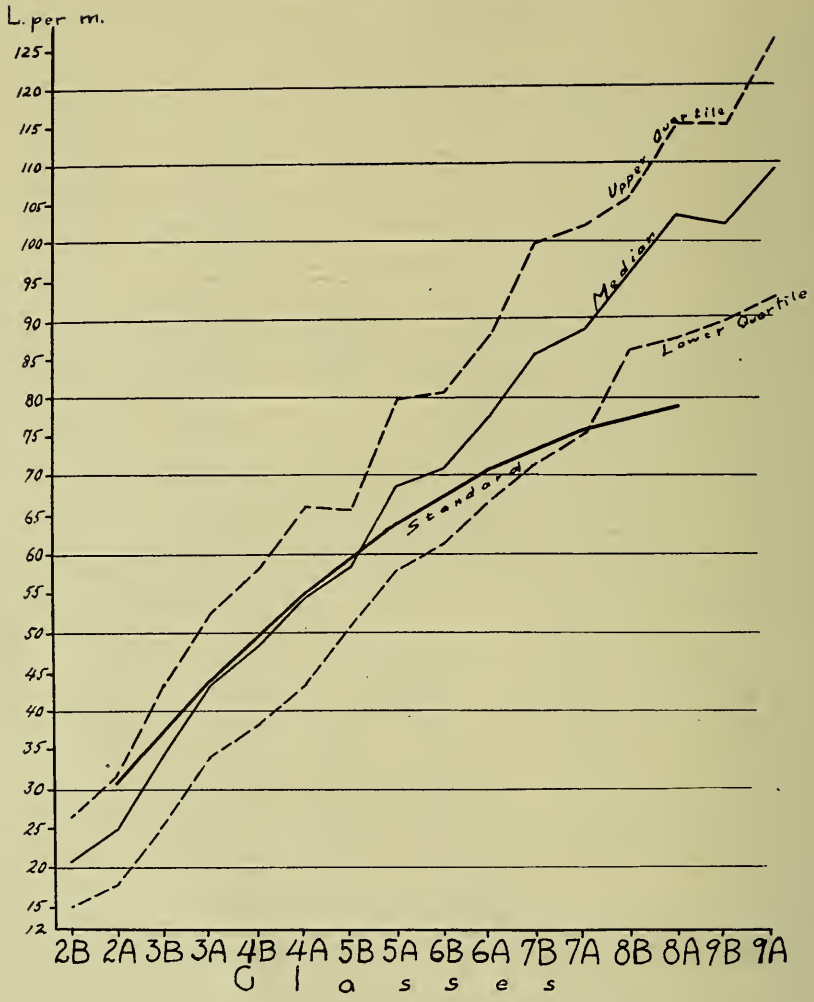
Grade	Berkeley	St. Louis	Richmond	Ayres Standard
2	38.0	29.9	.....	38
3	37.8	31.8	38.4	42
4	40.2	36.7	44.5	46
5	41.1	49.4	56.8	50
6	42.2	57.0	54.3	54
7	45.3	63.4	65.9	58
8	44.6	74.3	67.0	62
9	47.7	.....	.....	....

* See sources of data given in footnotes to Table V.

INTERPRETATION OF DATA

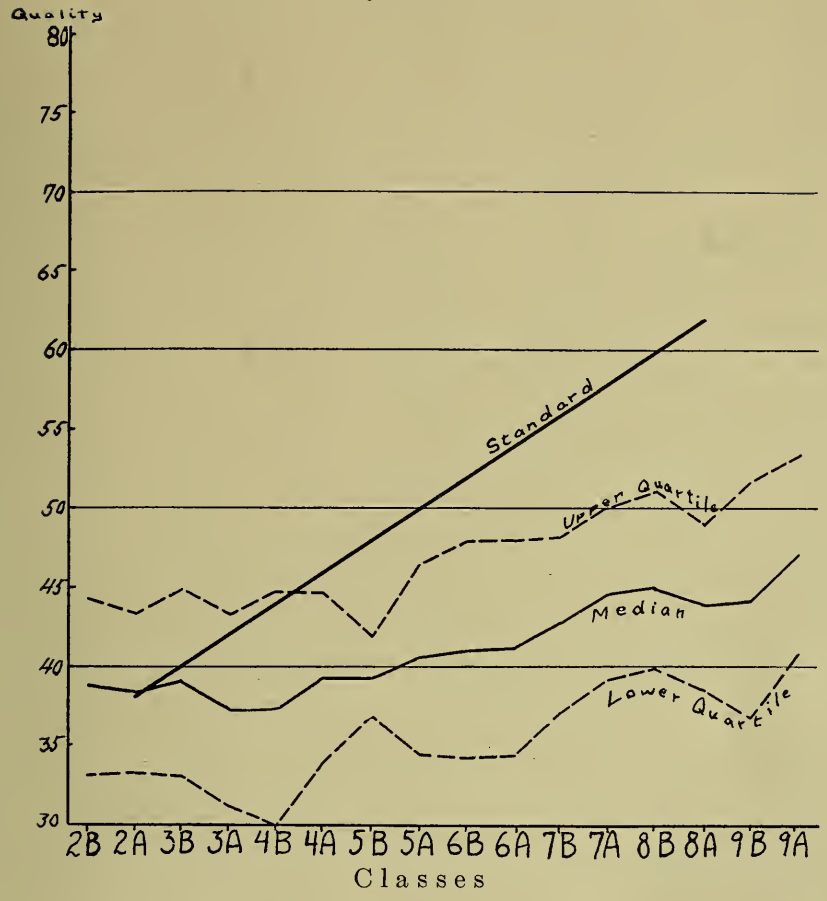
Tables I and II are tables of distribution for speed and for quality; Tables III and IV are derived tables showing the central tendencies for the several grades. It will be seen from a study of the figures in Tables III and V, and the graph in Diagram I, that the children of Berkeley excell to a marked degree in speed from the fifth grade on. In the Intermediate schools this superiority in speed is very marked; even the median of the lower half of the children is superior to the standard as set up by Ayres. (Note the position of the lower quartile in relation to the standard curve in Diagram I.) The Ayres Standard, moreover, is approximately the average of the ability of a great many thousand children; it is widely recognized as a satisfactory working standard.

DIAGRAM I. SPEED IN HANDWRITING



Exactly the opposite condition is found to exist in regard to quality of handwriting. The median attainment for Berkeley children is decidedly below the Ayres Standard after the low third grade (Tables IV and VI). A more striking feature of the situation, however, is revealed by a study of Diagram II, which is based upon the figures of Tables IV and VI. The median attainment in the Berkeley low second grade is 39 (on the Ayres Scale) and in the low ninth it is only 49—an improvement of ten points. According to standards widely accepted throughout the country the attainment for the eighth grade and beyond

Diagram II. Quality in Handwriting.



ought to be at least 63 or 64. Diagram III, which is based upon the figures of Tables V and VI, shows the facts of the situation by the two-co-ordinate method. Whereas the Standard attainment in quality progresses regularly from 38 to 62, and whereas the curves for St. Louis and for Richmond approximate this curve, Berkeley fails to get beyond the 50 mark at any point. On the other hand, the superiority in speed stands out very clearly. Apparently the children of Berkeley write faster than other children—and with greater illegibility. For the teaching force the problem facing them would seem to be very clear: emphasis needs to be placed upon formation and excessive speed should not be allowed to destroy legibility. It has often been stated that a happy medium must be found between the two, and the recommendation seems to strike home in Berkeley with particular force.

DIAGRAM III. SPEED AND QUALITY HANDWRITING

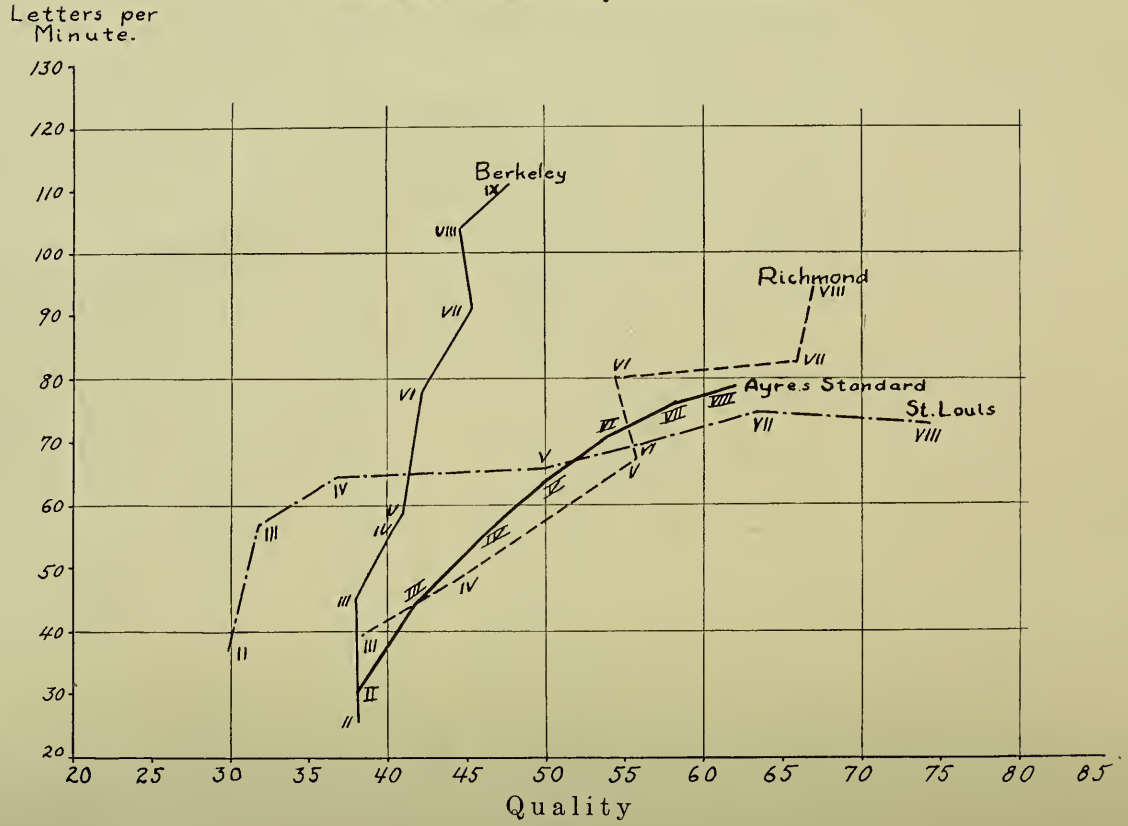
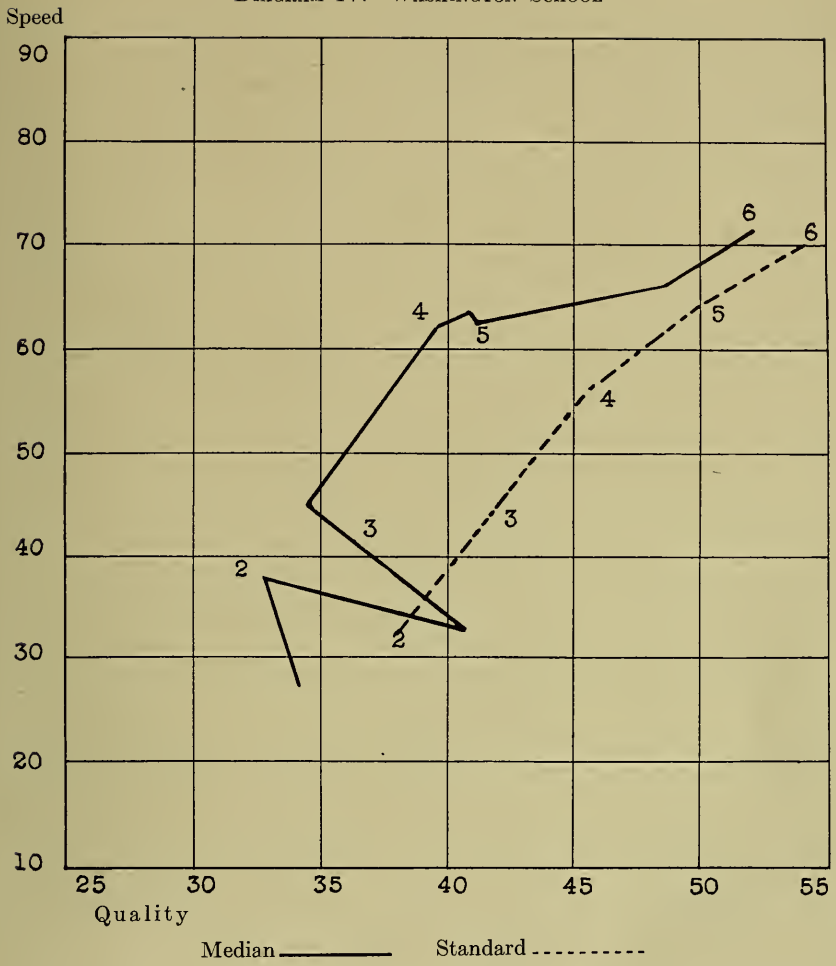


Diagram IV. Washington School



It may be noted in passing that the lack of drill in letter formation —and the process of producing writing—is also apparent in the lack of any pronounced similarity in the handwriting of the Berkeley children. This factor cannot be shown in any tables, but was noted again and again by members of the Seminar. Whereas in many systems where writing is extensively taught and supervised,—in short, where there is a strong central direction in the subject of penmanship,—there is naturally a very considerable degree of uniformity of style and size of letters, in Berkeley there is a lack of any uniformity, unless the tendency to a very small writing may be deemed a type of uniformity.

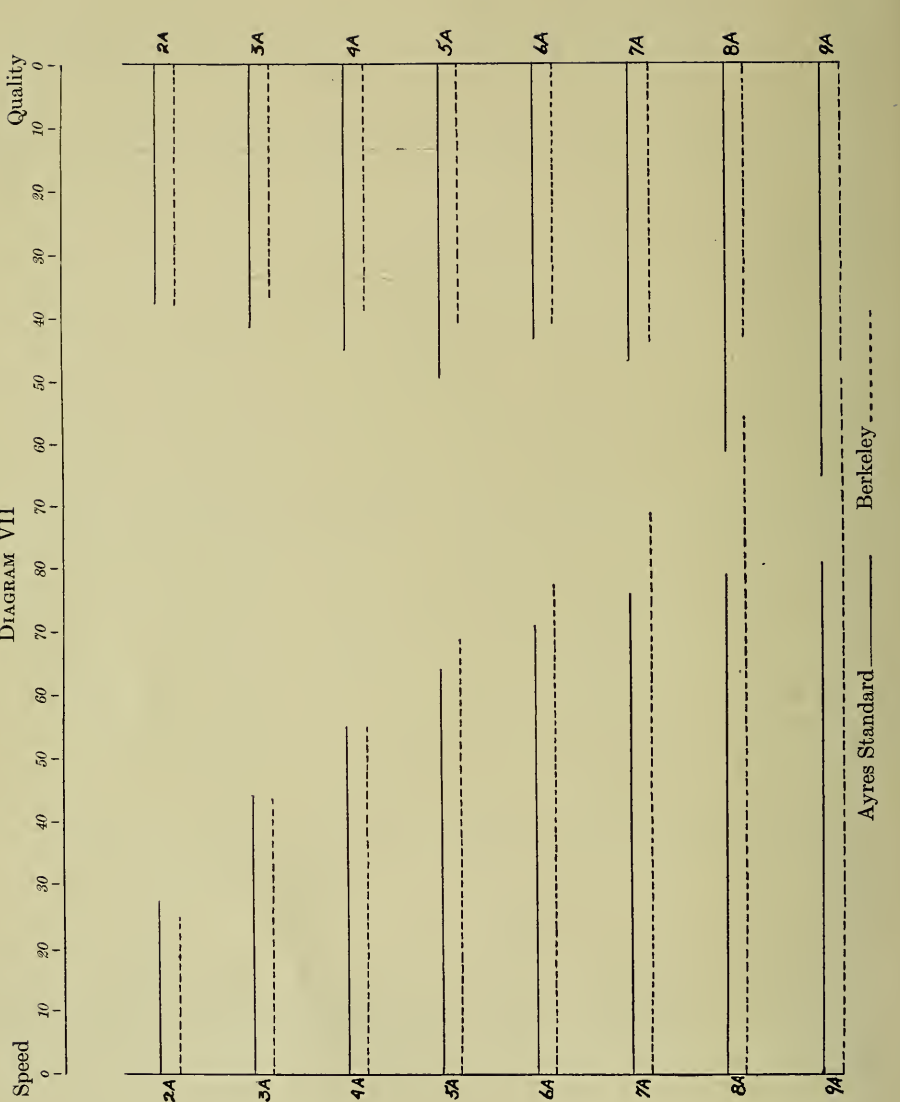
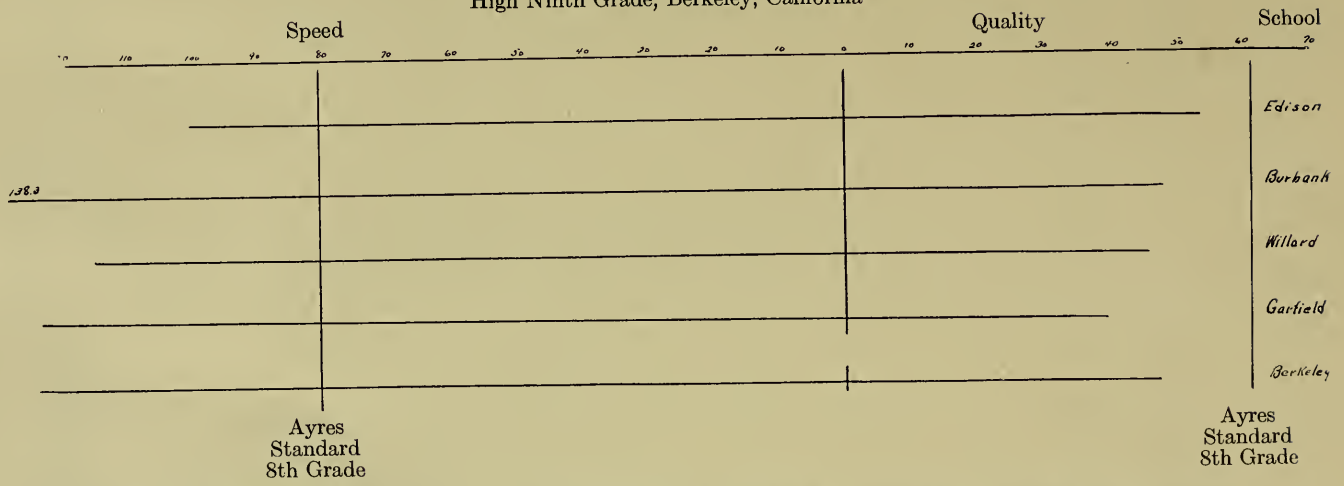


Diagram VII
Speed
Quality
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
2A
3A
4A
5A
6A
7A
8A
9A
Ayres Standard
Berkeley

DIAGRAM VIII

HANDWRITING

High Ninth Grade, Berkeley, California



High Ninth Classes (medians) in four intermediate schools compared with Ayres Eighth Grade standards (averages).

Table VII

Washington School

Number of Pupils in Each Grade at Each Speed

Speed	10	20	30	40	50	60	70	80	90	100		Total	Median	Quartile
2B	3	14	10	1								28	27.9	6.6
2A		3	16	13								32	38.1	5.4
3B	1	13	13	3	4							34	32.3	6.5
3A		4	20	21	3	2	1					51	40.7	6.2
4B		2	10	8	9	4						33	45.6	9.5
4A		1	0	10	7	7	9	2	2			38	61.4	12.7
5B			4	7	14	23	13	2	2			65	63.3	8.8
5A			1	5	9	11	6	1	2			35	62.3	8.6
6B			1	1	7	10	8	3				30	66.0	8.3
6A			1	0	2	9	7	3	0	3		25	70.7	8.0
Total.....	4	37	76	69	55	66	44	11	6	3		371		

Number of Pupils in Each Grade at Each Quality

Quality	10	20	25	30	35	40	45	50	55	60	65	70		Total	Median	Quartile
2B		1	1	14	5	6	1							28	34.3	4.1
2A	1	5	3	12	3	8								32	33.0	5.9
3B			1	3	11	11	4	2	1	1				34	40.9	4.0
3A			6	14	20	8	3							51	36.4	3.6
4B			6	11	6	5	3	2						33	34.8	7.7
4A			1	7	12	9	4	3	2					38	39.6	4.6
5B		1	1	9	18	19	7	3	4	3				65	40.9	3.9
5A			4	6	6	9	4	2	3	1				35	41.0	6.4
6B					2	8	7	7	3	2	0	1		30	48.6	5.2
6A						5	6	3	7	2	1	1		25	52.1	6.2
Total.....	1	7	23	76	83	88	39	22	20	9	1	2		371		
								15 per cent								

Table VIII

McKinley School

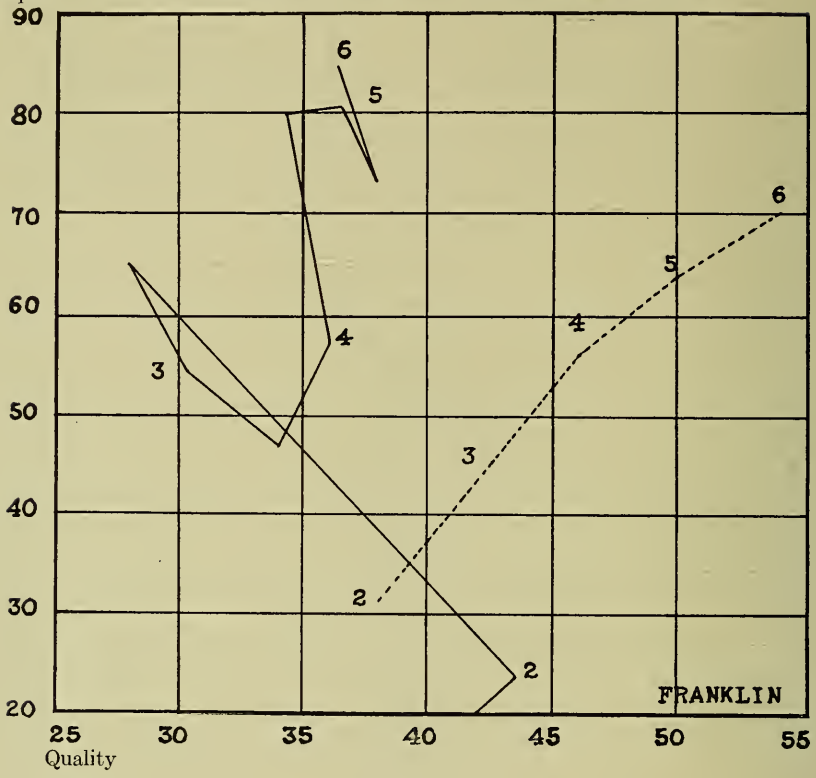
Number of Pupils in Each Grade at Each Speed

Speed	10	20	30	40	50	60	70	80	90	100	110	120	130	Total	Median	Quartile
2B	10	5												15	17.5	4.9
2A	5	8	4	1										18	25.0	6.1
3B	1	9	4											14	26.7	3.2
3A		6	6	3	2									17	34.1	7.7
4B		1	5	6	3	5	2							22	48.3	7.0
4A			5	7	2	1	1							16	44.3	6.0
5B		8	8	10	5	4								35	41.5	9.8
5A		2	0	4	5	5	2	2						20	58.0	10.3
6B				10	4	6	7	2	1	0	0	1		31	62.5	13.4
6A				4	7	5	5	8	1	4	0	1	1	36	74.0	12.1
Total.....	16	39	32	45	28	26	17	12	2	4	0	2	1	224		

Number of Pupils in Each Grade at Each Quality

Quality	10	20	25	30	35	40	45	50	55	60	65	70		Total	Median	Quartile
2B			1	4	6	1	2	1						15	37.1	3.9
2A				2	8	6	2							18	39.4	3.2
3B			1	6	3	1	0	1	2					14	35.0	5.2
3A		1	2	2	1	8	2	1						17	41.6	4.6
4B			3	4	8	5	2							22	37.5	3.7
4A				7	4	5								16	36.3	4.1
5B		3	6	7	11	2	3	2	1					35	35.7	5.1
5A			1	8	3	4	2	2						20	36.7	5.7
6B			2	4	11	8	4	2						31	39.3	3.0
6A	1	1	7	10	7	3	3	3	1					36	34.5	5.9
Total.....	1	5	23	54	62	43	20	12	4					224		
								7 per cent.								

DIAGRAM IX. Speed and Quality of Handwriting of pupils, grades 2 to 6, in one elementary school, compared with the Ayres standards.



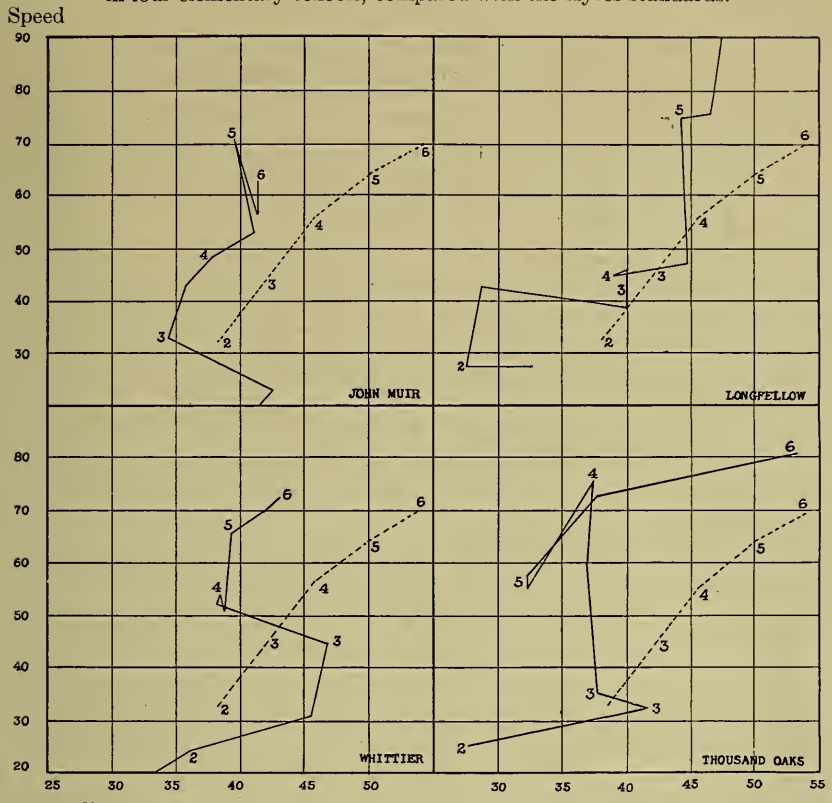
average person is to use in after life. The need of the specialist may well be considered a vocational problem, but the need of the masses is the creed of the school.

COMPARISON OF TYPICAL SCHOOLS

Tables VII and VIII are tables of distribution for speed and quality in two typical schools, the Washington and McKinley. The Washington represents the type approaching more nearly the standard curve for both speed and quality, and the McKinley, the type with the greatest deviation from the standard curve.

It will be seen from a study of the figures in these tables that the pupils in both schools in speed and also quality approximate closely in their distribution, a normal probability curve. However, the range in speed of the McKinley pupils is much greater than that of the

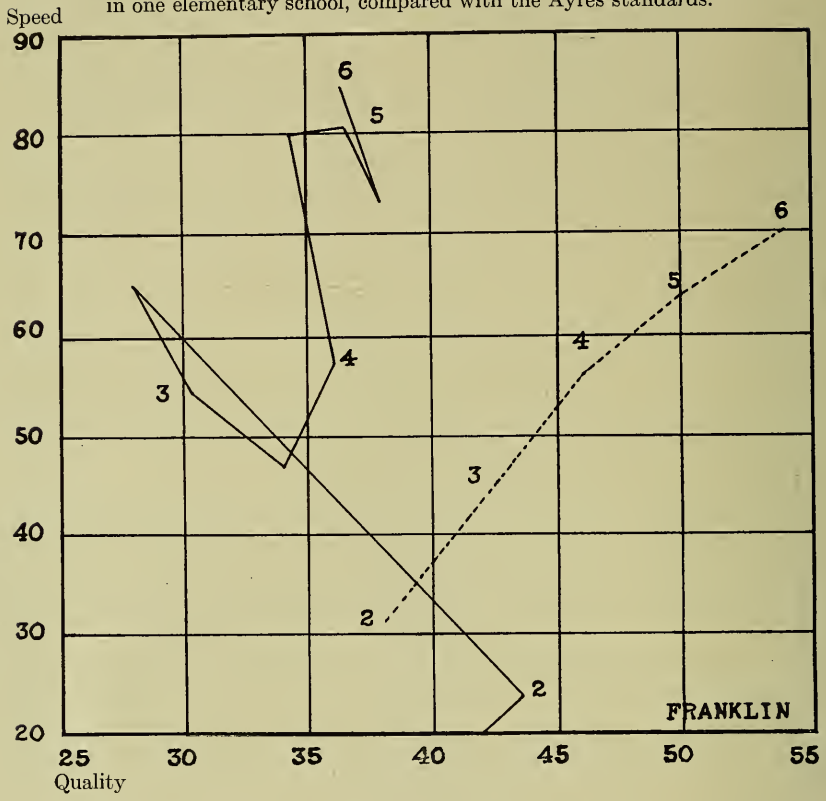
DIAGRAM X. Speed and Quality of Handwriting of pupils, grades 2 to 6, in four elementary schools, compared with the Ayres standards.



Washington pupils, but the range in quality is considerably less. Also it will be seen that only 7% of the pupils in the McKinley school score (on the Ayres scale) 50 or above, a standard shown by Koos in a recent study to be high enough to meet the needs of the world at large. While in the Washington school 15% of the pupils have attained that standard. Diagrams IV and V show in a graphical form the medians of grades 2B to 6A inclusive in both schools compared with the Ayres standard curve. Similar data for all remaining schools are pictured in Diagrams IX, X, XI, XII, XIII.

In an elementary school comprising the first six grades it seems fair to assume that the attainment of the high sixth class is typical of the school, therefore Diagram VI is included in this survey for the purpose of making a comparative study of the various schools in the city. Diagram VIII pictures the same data for the Junior High Schools.

DIAGRAM IX. Speed and Quality of Handwriting of pupils, grades 2 to 6, in one elementary school, compared with the Ayres standards.



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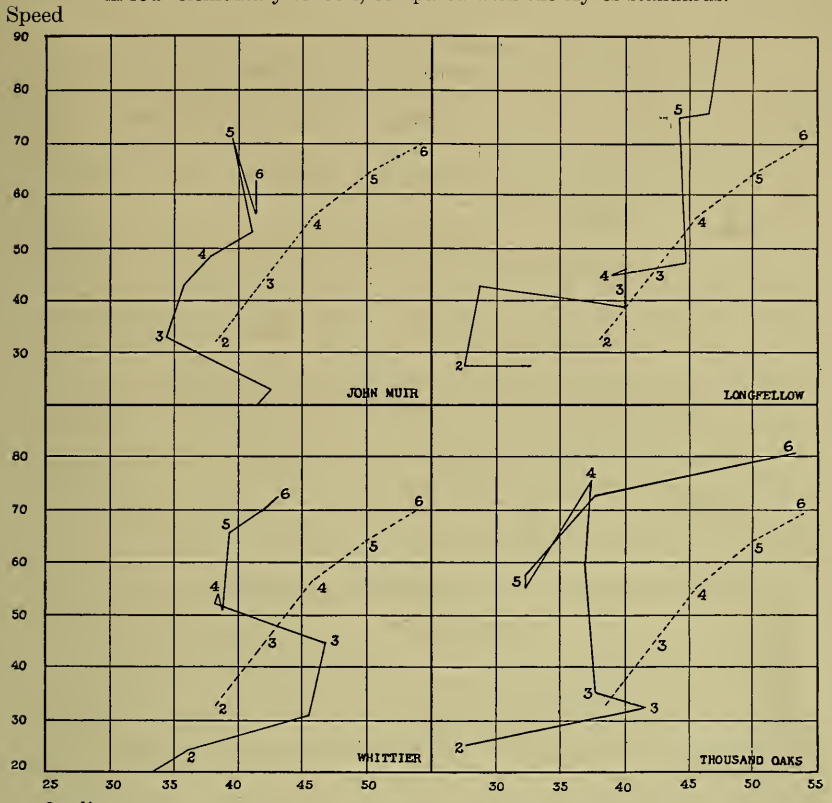

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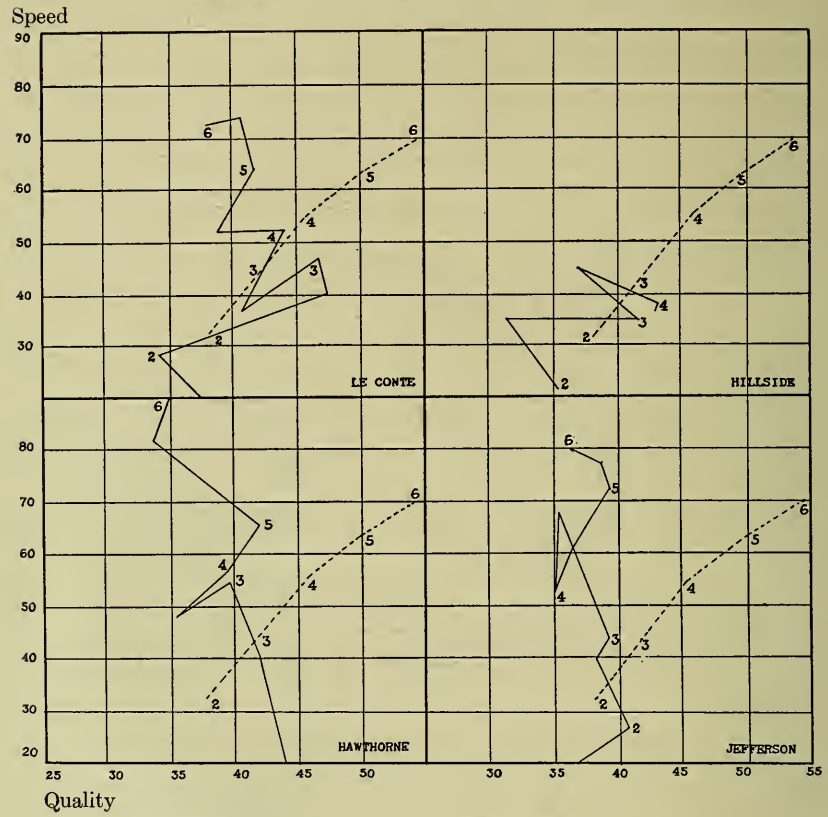
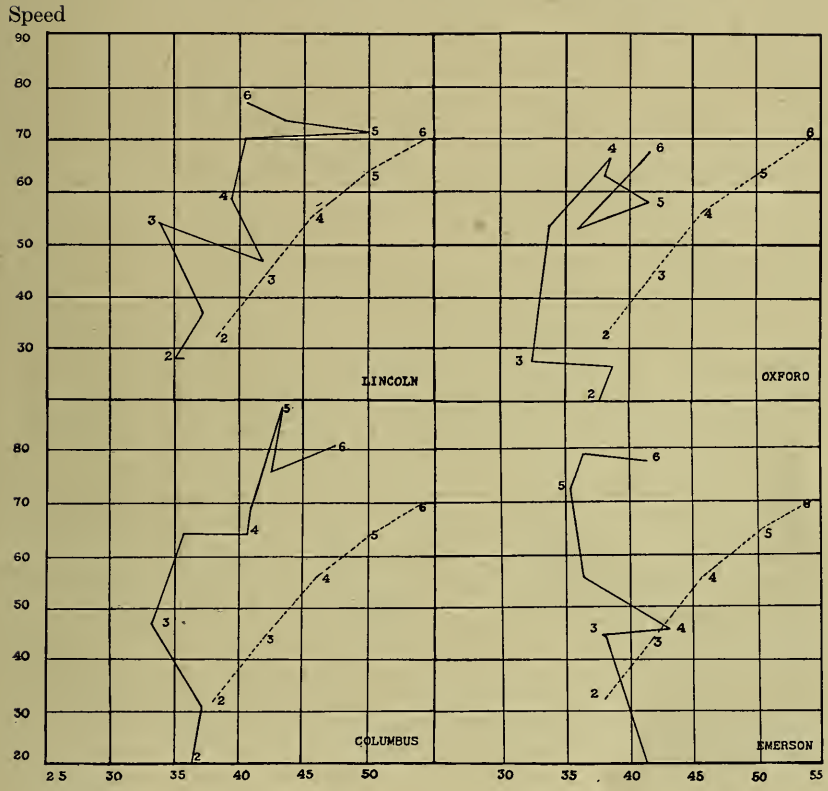
Diagram XI. Speed and Quality of Handwriting of pupils, grades 2 to 6, in four elementary schools, compared with the Ayres standards.



(Berkeley Medians ———; Ayres Averages - - - - - - - -)

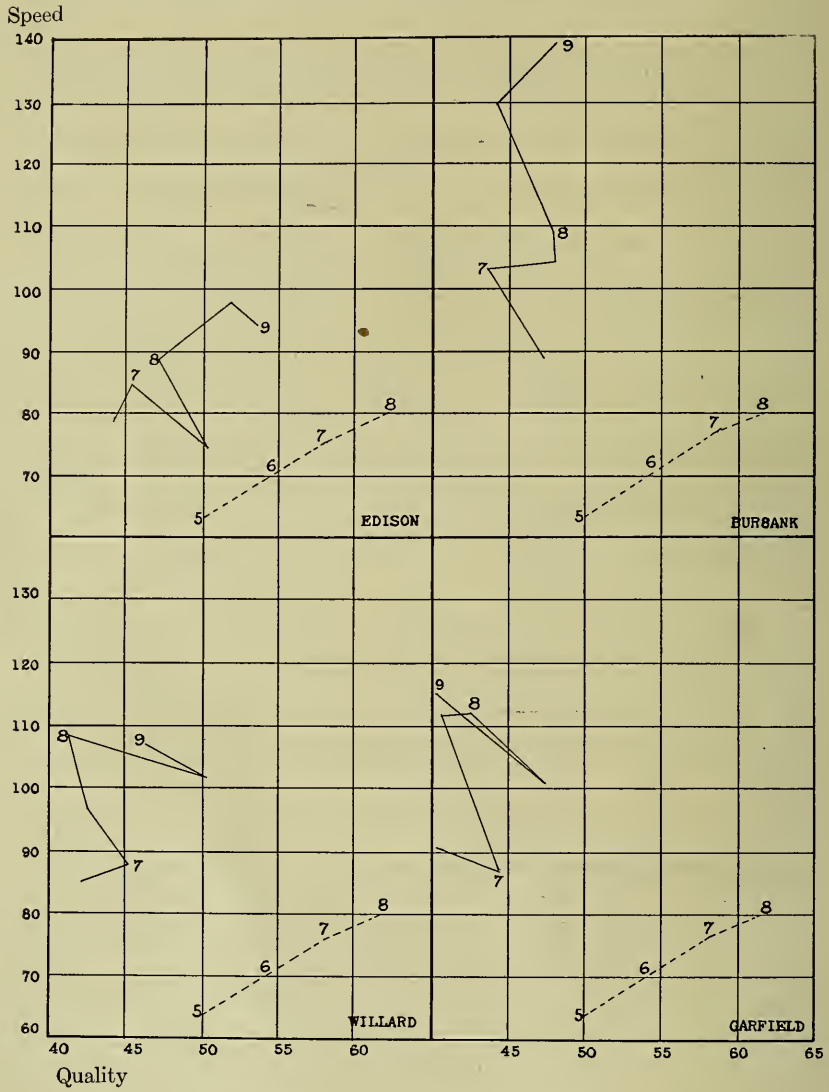
In Berkeley where the speed in all grades above the fourth in most of the schools is much beyond the standard it would seem to be the problem of such schools to lay great stress upon the development of quality even at the expense of speed if quality has not kept pace with speed. Diagram VII shows in a marked way to what an extent speed has been developed in the Berkeley schools in all grades at the expense of quality.

Diagram XII. Speed and Quality of Handwriting of pupils, grades 2 to 6, in four elementary schools, compared with the Ayres standards.



(Berkeley Medians_____; Ayres Averages - - - - - - - -)

Diagram XIII. Speed and Quality of Handwriting of pupils, grades 7 to 9, in four intermediate schools, compared with the Ayres standards.



For the sake of those who may be interested in reading for themselves concerning the status of writing as revealed in current educational comment the following brief bibliography is appended.

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CHAPTER II

REPORT OF THE COMMITTEE ON SPELLING

Material for the Test and Plan of Giving

On March 13, 1919, at the same hour in a given school, the pupils from the low second to the high ninth grades inclusive were asked to spell twenty words. The words were chosen from the Ayres Measuring Scale for Ability in Spelling. It has been found that classes make, on the average, a grade of 73 per cent. when they attempt to spell these words. These lists were the same that were dictated to the children of the Cleveland Ohio Survey. Several days before the day of the test the principals and teachers received the following bulletin of instructions from the office of the Superintendent:

Instructions Concerning Spelling Tests

Berkeley, California,
March 12, 1919.

To Principals and Teachers:

On Thursday, March 13th, a representative of Professor Mead's Seminar will come to your school for the purpose of giving, or assisting the teachers in giving, a test in spelling from the second to the ninth grades inclusive. Lists of words will be provided by the above representative. Do no "teaching" of the words. Provide your class with such material as they regularly use in a spelling lesson. See that each pupil writes his name, date, grade (A or B), and school. Dictate the spelling list as you would ordinarily in a written spelling period. If necessary, you may use a word in a sentence in order to make clear its meaning. Have the pupils spell, however, only the word. Collect and immediately mark all papers on the percentage basis, writing the score in the upper right hand corner, deducting five per cent. for each misspelled word. An omitted word should be counted as an incorrect spelling. Attach the spelling list to the papers and hand the same, properly clasped, to the representative. It is important that this test be given Thursday, preferably Thursday morning. Please see that the above directions are followed implicitly.

Very truly,
H. B. Wilson,
Superintendent of Schools.

Oral Instructions

In addition to this, the representative was authorized to give such oral instruction to the teachers as seemed necessary for a clear understanding of what they and the children were expected to do. The most important of these oral directions were:

1. Not to tell the children they were taking a "test."
2. Dictate at the usual writing speed of the class.
3. The teacher to number the words as they were dictated.
4. If the pupil began a word incorrectly, then changed it, it was to be counted right, if correctly done at last, if the teacher was sure the word was not copied.

Tabulation of Results

The papers were collected and marked by the teachers, then turned over to the waiting representative who later revised the gradings. It was interesting to discover that almost as many papers had, in the haste of marking, been marked too low as too high. Where some percentages had to be lowered five or ten points, others had to be raised ten or fifteen. The spelling committee advises, that in the test of next term, more time be allowed for this part of the teachers' work.

The score of each grade was tallied on sheets like the accompanying form which shows the record for a typical A sixth grade, and upon these sheets was computed the correction on the guessed average to get the true average.

The grade scores and averages were assembled upon two different forms. One form showed the scores and averages for each grade in a particular school; the other form showed the scores and averages of the same grade in all the schools. Upon the totals found upon each sheet, the committee has computed the guessed and true average, the average deviation, the median, and the quartile deviation. The number of computations on each sheet was fourteen. Where there were several classes of a grade, as for example, six in the high seventh of the Willard School, the computations were increased to the number of twice the additional divisions. The thirty-five sheets necessary to formulate this report represent a total of four hundred ninety computations without the additional pairs made necessary by the three, four and six-fold divisions of several grades. This will explain the fact that several months passed before the results of the tests were made accessible to teachers.

TYPICAL SCORE, SIXTH A GRADE

Spelling

0		
5		
10		
15		
20		
25		
30		
35	2	
40		
45		
50	3	
55	1	
60		
65	2	
70	1	
75	2	
80	1	
85	2	
90	2	
95	2	
100	1	
N.	19	
Guessed Av.	77.5	
True Av.	73.3	

Factors to be Considered in Interpretation of Results

Before discussing the tabulations and graphs, attention is invited to the following facts:

The test was given on March 13, four weeks and three days after the mid-year promotions which were made on February 10. The achievement of Berkeley as a whole is not, therefore, entirely comparable with that of those cities where the test was given at the mid-year period. In other words, the B section of every grade was much nearer to the A section of the grade below, than to the A section of their own grade.

The second thing that must be taken into consideration in interpreting Berkeley's record is that there was an enforced vacation due to the influenza totaling nine weeks. For purposes of comparison, however, the results with the B, or lower, sections were not used. The average results of the A or upper, section of each grade were used in the comparison of Berkeley with other cities. As a matter of fact then, these A sections were still about four weeks short of the mid-year.

A third point should be kept in mind. In the Berkeley Survey there was no sampling, but every spelling was used. 5814 children of the city spelled, or attempted to spell, twenty words each. The tabulations therefore represent 116,280 spellings. In no other survey, so far as known, has this been true. San Francisco was notably sampled even after the spelling was given in only a part of the schools of the city.

In another way the Berkeley Survey is unique. The entire teaching staff of the Elementary and the Intermediate Departments had an important part in it. In other cities with which Berkeley has been compared, the tests were conducted in the main by persons who were strangers to the children. In Berkeley unfamiliar personalities were not a confusing element. This should have induced a better performance on the part of the children. The participation of the teachers in the work brought out re-actions impossible if classes had been visited and tested by outsiders. Those re-actions are bound to result in great good to the schools because intelligent criticism and helpful suggestions are most desirable if real growth is to be secured.

Table I

Showing Distribution of Spelling Scores for Berkeley—Regardless of School

Form III.—Spelling—Berkeley Elementary Schools

Score	2B	2A	3B	3A	4B	4A	5B	5A	6B	6A	7B	7A	8B	8A	Total
0	29	8	8	2	7	....	4	....	3	1	2	....	1	....	65
5	26	9	4	1	11	....	4	1	2	....	....	....	4	....	62
10	28	19	12	3	14	3	7	5	1	....	3	3	2	....	100
15	21	8	17	3	20	5	12	6	4	2	9	2	5	3	117
20	26	15	18	2	19	9	12	8	8	2	15	3	6	4	147
25	18	10	19	6	16	6	15	16	12	6	12	11	9	8	164
30	12	10	15	3	25	19	15	8	11	6	15	13	15	6	173
35	17	12	13	12	18	26	12	18	12	7	17	9	10	7	190
40	10	10	17	13	28	19	21	25	15	8	14	17	15	23	235
45	9	19	17	10	21	27	17	21	21	10	27	15	16	17	247
50	12	17	27	20	27	21	24	22	14	17	22	30	23	24	300
55	14	21	18	25	27	34	18	31	22	11	28	19	28	19	315
60	17	19	11	18	21	29	29	36	31	24	18	29	20	20	322
65	12	22	22	14	19	40	20	29	38	21	27	23	31	30	348
70	9	18	17	15	22	31	23	21	27	30	33	39	28	23	336
75	9	18	21	32	25	31	25	34	25	36	23	43	17	30	369
80	8	24	15	25	21	27	32	32	26	40	24	43	21	29	367
85	7	30	17	31	13	27	14	35	38	54	37	33	17	37	390
90	11	24	14	48	14	27	29	39	24	55	27	45	10	41	408
95	6	31	9	44	6	37	16	23	40	52	14	36	11	33	358
100	2	27	13	29	2	20	9	19	24	39	9	26	6	15	240
Number	303	371	324	356	376	438	358	429	398	421	376	439	295	369	5253
Guessed Average	32.5	67.5	52.5	77.5	52.5	67.5	57.5	67.5	72.5	82.5	62.5	77.5	62.5	72.5	62.5
True Average	38.6	62.7	56.	74.4	51.12	66.5	60.8	66.65	69.15	78.65	62.57	72.	61.5	71.6	64.4
A. D.	24.15	24.8	23.07	18.6	21.1	18.6	21.7	19.2	19.2	15.15	18.05	17.5	17.7	17.55	21.7
Median	31.5	66.9	54.07	79.84	51.66	67.6	63.1	68.01	70.92	83.7	66.1	75.17	62.	75.8	67.7
Quartile	16.42	21.18	20.45	17.76	20.3	15.51	17.31	15.7	15.23	13.02	16.12	14.14	13.23	12.8	20.4

Table II

Average Score Made by the High and Low Sections of Each Grade in the Elementary and Intermediate Schools, Berkeley, California

	2B	2A	3B	3A	4B	4A	5B	5A	6B	6A	7B	7A	8B	8A	9B	9A	Ungraded	Average
Columbus	16.2	45.9	48.1	66.5	36.8	70.4	54	70.6	78.5	87	....	....	....	....	....	....	....	59.1
Emerson	37.5	56.5	42.5	85.2	51.3	77.8	63.8	62.2	81.3	75.8	....	....	....	....	....	....	....	65.8
Franklin	44.7	66.2	44.8	76.7	44.6	55.8	47.3	60.4	63.3	61.5	....	....	....	....	....	....	....	55.9
Hawthorne	11.9	38.2	40.1	70	40.7	44	66	70.9	70.7	81.4	....	....	....	....	....	....	....	52.1
Hillside	60.8	73.8	47	63.3	62.8	67.2	75.2	55	—	—	....	....	....	....	....	....	....	65.4
Jefferson	22.5	50.7	65	84	57.5	69	45.5	70.7	64.2	73.3	....	....	....	....	....	....	....	62.6
John Muir	32.5	72.5	53.9	79.7	56.5	64.8	58.9	60.4	66.6	79.2	....	....	....	....	....	....	....	62.9
Le Conte	69.3	61.8	64.7	75.3	65.6	62	69.1	64	69.7	78.3	....	....	....	....	....	....	....	68.6
Lincoln	56.5	81.7	76	74	51	69	73.4	72	68.7	83.1	....	....	....	....	....	....	....	69.5
Longfellow	26.4	38	33.5	74.5	56.6	63.1	74	72.6	82.4	84	....	....	....	....	....	....	47.9	62.3
McKinley	41	56.7	50.6	81.3	49	63.5	45.9	62.9	57.5	76.1	....	....	....	....	....	....	....	59
Oxford	16.9	51.1	44.9	56.3	41.1	64.8	58.1	54.2	70.5	70.8	....	....	....	....	....	....	....	56.3
Thousand Oaks	—	60.8	68.5	63.5	59.7	72.5	51.5	—	79.4	70.5	....	....	....	....	....	....	....	62.7
Washington	45.3	88.8	70.4	79.1	50.4	64.3	56.8	74.1	67.8	89.1	....	....	....	....	....	....	....	67.5
Whittier	30.5	68.1	48.7	77.9	56.9	81.1	66.5	68.6	63.5	78.5	....	....	....	....	....	....	....	66.1
Burbank	....	....	....	....	....	....	....	....	....	....	53.2	71.6	65.9	79.2	72.9	81.6	....	*68.7
Edison	....	....	....	....	....	....	....	....	....	....	70.5	75.9	59	72.9	82.2	80.8	....	*69.5
Garfield	....	....	....	....	....	....	....	....	....	....	67.6	72.8	64.3	75.8	72	80.7	....	*70.2
Willard	....	....	....	....	....	....	....	....	....	....	59.1	68.8	59	66	70.2	76.4	....	*64.7
Average	36.6	60.7	53.2	73.9	52.0	65.9	60.4	65.6	65.6	75.2	62.6	72.3	62.1	74.2	74.3	79.9	....	†69.7

* Average for Intermediate Schools for Seventh and Eighth Grades only. (These averages were made from the total distributions, not an average of averages).

† 69.7 Average of averages for A Divisions 2 to 8 inclusive.

Table III

Table of Averages—A Sections

(Averages of Averages)

	Grade II	Grade III	Grade IV	Grade V	Grade VI	Grade VII	Grade VIII
Standard	73	73	73	73	73	73	73
Berkeley	60.7	73.9	65.9	65.6	75.2	72.3	74.2

Interpretation of Results

Table I (Distribution of Spelling Scores for Berkeley, Regardless of Schools) shows the total number of distributions of each measure for the different grades throughout the Berkeley system. For illustration: out of the 371 pupils in the A second grade, 27 made a score of 100 per cent., while the entire number of second grade pupils made an average of 62.7 per cent.

Table II (Average Score made by the High and Low Sections of Each Grade, according to schools) when read horizontally shows the class average of each school for each of the grades and also the average for the school. When read perpendicularly, it shows the average by grades in each school and for the system.

Table III (Table of Averages) represents the averages of the class averages, by grades, in the entire system regardless of schools. Thus the average of all the second grades (A Div.) in Berkeley is 60.7 per cent.

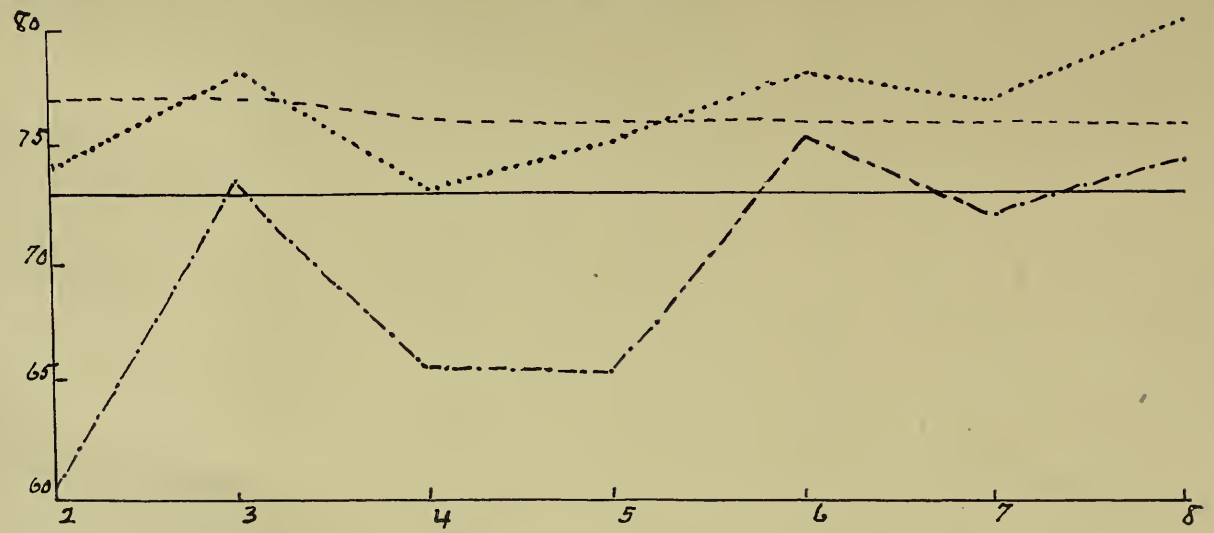
The averages pictured in Chart I (Averages of Averages) show that the Berkeley Schools, as a whole, are a little above the 73 per cent. score in the third, sixth and eighth grades, but that the second, fourth and fifth grades fall surprisingly low, while the seventh closely approximates the 73 per cent. point. The equality of the fourth and fifth grades in negative ability is significant and gives rise to several questions regarding the causes for the condition. The average for the entire City of Berkeley is 69.7 per cent.

A comparison of Berkeley's record with that of Cl veland brings out the fact that in both cities good and poor spelling ability lies, relatively, in the same grades. The very low attainment of the second grade is probably due to two facts: (1) spelling as a subject is not regularly taught in all the first grades; and (2) in nearly all the classes the second grade children were using paper and the pencil as a medium for the first time on the day of the test. We do not understand the low scores of the fourth and the fifth grades. Since the same grades in Cleveland occupy the same relative position, there is perhaps some unknown factor that influenced the achievement in both cities. This suggests further study.

CHART I

BERKELEY PUBLIC SCHOOLS

Average Score in Spelling Made by A (High) Section of Each Grade from the Second thru the Eighth.
March, 1919.



_____ 73 per cent. Standard (mid-year).

—·—·—. Berkeley, four weeks short of mid-year.

- - - - - - Standard 1or both A and B sections, at close of year, when A sections are completing grade. (See Cleveland Survey, pages 243-244.)

..... Cleveland. (Both sections at close of year.)

Not only is there a wide difference between the same grades of the different schools in Berkeley, but the range within the individual schools is in some instances very large. The variation in the averages made by the different grades in the Berkeley Schools, as shown in Table II, is from 60.7 per cent. in the second grade to 75.2 per cent. in the sixth, a variation of 14.5 per cent. In Cleveland the range is from 73 to 80 per cent., a variation of only 7 per cent. In the Elementary group, the school having the greatest range shows a spread from 16.2 per cent. in the B second to 87 per cent. in the A sixth. The one showing the least variation extends from 61.8 per cent. to 78.3 per cent. In the Intermediate group, (seventh and eighth grades only) the same thing is true. The greatest range is from 53.2 per cent. to 79.2; the least from 59 to 68.8 per cent. The fourth grades (A Div.) which average 65.9 per cent. have a reach from 44 per cent. to 81.1 and the fifth grades (A Div.) which average 65.6 per cent. offers 54.2 per cent. as the lowest grade average, and 74.1 as the highest.

To arrive at a more definite conclusion regarding the causes of this condition, detailed studies of the causes of pupils' misspellings would have to be made. Such a study is suggested by Monroe in "Measuring the Results of Teaching," pages 192 to 202.

Time has not permitted this, therefore the Committee is not willing to hazard an opinion. One thing however does seem to be indicated, and that is, that there is too much attention given to the spelling of mere lists of words which the pupil may already know, and not enough to systematic development of the ability to attack a new word. Inattentive application to what one already knows produces a mental apathy which can soon become a fixed habit.

Recommendations

In view of the fact that a more complete diagnosis cannot be made at this time, the Committee is limited in the kind and the number of the recommendations that it can make. The first and the most important from the Committee's point of view is that a copy of each grade and school sheet, a copy of the tables of averages, and of the graph, be furnished to every school in each group and that the schools themselves study these results and endeavor to arrive at a conclusion which may be passed on to the teaching staff in order that a better and more uniform quality of work may be done in the grades.

To facilitate and illumine the study of these tabulations and graphs, we recommend that the Board of Education supply each school with one or more copies of the following books:

The Eighteenth Year Book, (the 1919 issue), in which there are forty-one principles of method in spelling presented as the last word from the Committee on Economy of Time in Education. This same Yearbook contains similar principles of method in reading, writing and arithmetic.

MONROE: *Measuring the Results of Teaching.* Houghton Mifflin Company.

TIDYMAN: *The Teaching of Spelling.* World Book Company

PEARSON and SUZZALLO: *Essentials of Spelling.* American Book Company

There is now in the hands of the Elementary teachers, and it should be in the Intermediate grades, a copy of the California Teacher's Manual of Spelling. This offers illuminating material for the teachers' guidance. An extensive bibliography is also listed in the Eighteenth Yearbook, to which attention is directed.

To facilitate the movement for an improvement in spelling ability, the Committee offers the following suggestions taken from the investigations previously mentioned and recommends that they be put into the hands of each teacher and acted upon immediately.

The Committee sees two phases of the matter, and has arranged the recommendations under two headings. For the teacher we submit guidance in the methods of teaching spelling. For the pupil—to be taught to him by the teacher—directions for the method of studying spelling.

I. Guidance in the Method of Teaching Spelling

1. The time, 15 minutes daily, devoted to spelling, should largely be spent on class instruction under the direction of the teacher; in other words, it should be devoted to *teaching* rather than to *testing*.

2. Any good plan of teaching may be followed. Suzzallo and Pearson in their recent text, "Essentials of Spelling," present the following excellent procedure:

a. Write the new word in its normal form on the blackboard. (Make use of the visual sense).

b. While writing it, pronounce it distinctly.

c. Develop the meaning orally, by calling on the pupil for a sentence using the word, or by giving yourself a sentence, or by defining the word.

d. Show the syllables into which the word is divided, either by drawing vertical lines between the syllables (or lines under), or by covering the word so that but one syllable at a time is seen. Call upon the pupils to spell orally by syllables. (It is well to have the pupil form the habit of clearly pronouncing the word before and after spelling.) Have them indicate the part of the word that presents difficulties or the part that they already know.

e. Have the pupils write the word on practice paper several times, spelling it quietly as they write.

f. Allow the class a moment in which to look at the word again, then close the eyes and try to visualize it.

g. Provide plenty of repetition for drill, oral and written. (Some teachers give their pupils four or five minutes, say, to "study" their written word lists, after teaching, then have the class turn their papers over to spell from rapid dictation, this to determine the daily spelling grade).

3. For interesting methods of drill, the group contest in spelling games is recommended. S. A. Courtis' *Teaching Spelling by Plays and Games,* (82 Eliot St., Detroit) contains explicit directions for a number of such.

4. Teach the pupil to correct his own errors.

5. *Insist upon careful spelling in all written work.*

The committee wishes to emphasize the following negative matters in method:

1. Do not require a pupil "to write a word ten, fifteen or twenty times mechanically." Repetition should be accompanied by attention, and the teacher should know that such is the case.
2. Do not permit children to correct one another's spelling.
3. Do not call attention unnecessarily to the wrong wordform. For example, never say, "Do not use two l's in until." Say rather, "Notice the one l in until."
4. Do not drill upon words the children already know and do not drill upon all words alike.

II. Directions to be followed in Studying Spelling

The California Manual for the Teachers on page 8 says: "It is much more important that the child should know how to study new words than that he should be forced arbitrarily to memorize any fixed series of words." The teacher should then see that he knows how to study spelling. Excellent directions are to be found in the *Children's Preface* of the new California State Series of Spellers, and the teacher should see that each pupil understands and uses that method or some one equally good.

The pupil should be taught to keep in a note book an alphabetical list of the words which trouble him and his study of spelling should be directed to the mastery of his own difficulties.

Pupils should be taught now to use the dictionary in the study of spelling and then required to use it.

Pupils should acquire and be encouraged to use correct pronunciation as an aid to correct spelling.

As in the process of teaching there are some things one should not do, so in the process of learning there are some "do not's." Among them the following are to be stressed:

1. Do not *guess* at a spelling. Use the dictionary or ask the teacher.
2. Do not waste time in studying words you already know.
3. Do not write a word over and over without thinking about it. Write it a fewer number of times saying it quietly to yourself as you write.
4. Do not neglect to correct every misspelling in every piece of writing that you do.

The committee urges, that in the effort to raise the standard of ability, there be no increase of time allowance for spelling. It seems to be established conclusively that fifteen minutes daily is ample time if the methods followed are good. More time than that has not been shown to be more productive of power.

In conclusion the committee desires to say that in its opinion the emphasis should not be laid so much upon the fact that Berkeley did not do well, but upon the fact that it could do better. The only value that the survey can have is to stimulate to new and more intelligent efforts.

MEASURING CLASSROOM PRODUCTS IN BERKELEY

Study Number 1
of the Bureau of Research in Education

In two Sections—Section II

MAY 1, 1921

SURVEY: MEASURING CLASSROOM PRODUCTS IN BERKELEY

Section II of the report, made to Superintendent H. B. Wilson, on "Measuring Classroom Products in Berkeley." This survey was undertaken as a project by the 1918–19 Seminar in Educational Measurements. The 1920–21 Seminar has added the results in English composition and geography. Section I of December 1, 1920, includes the communications requesting the survey and the reports on handwriting and spelling. Section II, following, will include the work done in measuring reading, arithmetical abilities, composition and geography.

CYRUS D. MEAD,
Associate Professor of Elementary Education,
University of California.

CONTENTS

SECTION II

PAGE

Survey....49
Chapter III—Report of the Committee on Reading....53
Planning for the Tests....53
Directions for Giving....53
Oral Instructions....54
Giving the Tests....55
Tabulation of Results....55
Disclosures....65
General Relation Between Rate and Comprehension....67
Factors Influencing Rate and Comprehension....67
General Suggestions....69
Suggestions Applicable to Berkeley....70
Bibliography....72
Chapter IV—Report of the Committee on the Fundamentals of Arithmetic....74
Introduction....74
Planning and Giving Tests....75
Directions for Giving and Scoring....75
Oral Instructions....77
Collection and Assembling of Data....77
Explanation of Tables and Graphs....77
Interpretation of Results....82
Recommendations for Berkeley....91
Chapter V—Report of the Committee on Arithmetical Reasoning....92
Giving the Tests....92
Directions for Giving and Scoring....92
Comparison of Facts from Study of Tables and Graphs....93
Recommendations....97

APPENDIX

English Composition and Geography....98
Composition....98
Geography....102

CHAPTER III

REPORT OF THE COMMITTEE ON READING

Monroe's Standardized Silent Reading Tests were used in measuring the reading ability of 4714 pupils in Berkeley's nineteen schools. The tests were given on the afternoon of April twenty-fourth, nineteen hundred nineteen. The grades tested were the A-third to the A-ninth inclusive. All B-third grades were omitted and in a few schools the B-sixth and B-ninth also. This was necessary because there was an insufficient number of test sheets for all.

PLANNING FOR THE TESTS

Before the tests were given the manner of giving them was taken up in Dr. Mead's Seminar and carefully considered. A set of instructions to principals and teachers was worked out by the members of the Seminar. These instructions were incorporated by Superintendent Wilson in his official Bulletin Number 48 and sent out to each of the Berkeley principals and teachers prior to the giving of the tests. The bulletin read as follows:

THE PUBLIC SCHOOLS
BERKELEY, CALIFORNIA

BULLETIN NO. 48.
April 21, 1919.

DIRECTIONS FOR GIVING TESTS IN READING

To Principals and Teachers:

The tests in reading will be given to classes from the third to the ninth grades inclusive during Thursday afternoon, April 24. A representative of Professor Mead's Seminar will be at your school some time during the morning, at a time to be arranged by telephone, in order to distribute the material and assist the teachers in interpreting the directions for giving (and scoring) the tests, such directions being printed on page one of each pupil's test sheet (or on the class record sheet). It is of the utmost importance that uniformity of conditions prevail in the giving of these tests. A deviation from the regular

order of procedure would of necessity invalidate the result with your class. Principals will please make arrangements necessary for the representative to meet the teachers in group.

Administer the reading test as if it were an ordinary written exercise. Let natural conditions prevail. Do not have the pupils "fussed." Follow rigidly the directions and pay scrupulous attention to the *five-minute* time limit. Have a watch with a second hand. Have the pupils get ready five seconds before the minute, starting on the minute. It is well to add the five minutes to the time, writing it down. Call stop at exactly five minutes. Collect all papers immediately; score before leaving the building; place the Class Record Sheet on top of the class tests (disregard entering the scores on the Class Record Sheet); tie all into a compact bundle and hand to the Principal, who will send same to the Superintendent's Office by four o'clock the following day.

Very truly yours,

H. B. WILSON,
Superintendent of Schools.

Each member of the Seminar was given the responsibility of two schools. It was his duty to see that the teachers were provided with Individual Test Sheets, Class Record Sheets, and other materials needed in giving the tests and recording the results. The printed instructions to the teachers were supplemented and further emphasized orally by the Seminar member as follows:

ORAL INSTRUCTIONS FOR THE READING TEST

1. The test in a given school is to be given at the same period in the afternoon, all before, or all after an intermission.
2. Go over with the teachers in a group the method of giving and of scoring the tests. Advise the use of a pencil.
3. There are four rules to be followed in giving any standard test:
   (*a*) Follow the printed directions carefully.
   (*b*) Do no more nor less than the directions specify.
   (*c*) Do not try to improve upon the directions.
   (*d*) Watch the time of five minutes. Use a watch with a second hand. Record the time limit of starting and stopping by adding the five minutes to the time and entering the same in the upper left corner of the same sheet.
4. Be natural. Do not "fuss" the pupils.
5. Study the directions until familiar with them.
6. Return all unused copies of the tests.

7. Mark strictly as to marking lines under or around words. That is, take off if wrong, but use judgment in marking an exercise if the answer shows that the child understands.

8. If the value on any test sheet is blurred, refer to the clear sheet to get the value.

9. Put nothing on the Class Record Sheet except the heading and the time.

Each teacher was given opportunity to ask as many questions of the Seminar member as she cared to in order that the manner of giving the tests should be thoroughly understood. That the teachers were interested and anxious to make the tests effective was manifested by the number and the character of the questions asked.

Giving the Tests

The teachers gave the tests to their respective groups of pupils and scored the papers. This meant extra work for the teachers, but they willingly gave of their time and strength to accomplish the task quickly. The teachers not only scored the papers but they also arranged them in order so that the lowest comprehension score appeared at the top of the bundle of papers and the highest at the bottom. This saved the reading committee much time.

The answers to some of the questions on the test sheets were absolute, i.e., one answer was right, any other answer was wrong. The answers to other questions were left to the judgment of the one who did the scoring. Since there were so many who scored the tests it was thought best for the Seminar members to check the work of the teachers. The results were very satisfactory. In a few instances it was felt that a higher score had been given than the pupil had earned, so the final score was slightly lowered. In many more instances, however, it was felt that overly conscientious teachers had rated their pupils too low and the final score was raised. Throughout the giving of the tests there was ever manifested on the part of the teachers the desire to do everything "just right."

Tabulation of Results

The scores earned by the pupils of the various classes in each school were entered upon a special blank form (Class Record Sheet, Form I) issued by the Bureau of Educational Measurements and Standards, Kansas State Normal School, Emporia, Kansas. After the scores for comprehension were recorded on the Class Record Sheets, it was necessary to rearrange the bundles of individual score sheets on the basis

of the pupil's rate of reading. The rate scores were entered on the same Class Record Sheets as were the comprehension scores. From these scores were computed the medians for rate and comprehension for each class.

In order that the results of the tests might be easily compared, school with school and grade with grade, the committee devised two special forms of tabulation sheets, one for the rate scores and one for the comprehension scores. The accomplishments in both rate of reading and comprehension for the various grades in the city, regardless of school, are assembled in Tables I and II. These data are pictured in Graphs I and II.

The dotted line in Graph I represents the average score in the rate of silent reading of 4714 Berkeley pupils from the third through the ninth grades. The solid line represents the standard score of the same grades for other cities of the country. The figures on the top line of the diagram indicate the grades while those on the vertical line show the rate of reading (number of words per minute). The breaks between the fifth and sixth grades and the eighth and ninth grades represent the three different tests.

The dotted line in Graph II represents the average score in the quality or comprehension of silent reading of 4717 Berkeley pupils from the third through the ninth grades. The solid line represents the standard score of the same grades for other cities of the country. The figures on the top line of the diagram indicate the grades while those on the vertical line show the reading comprehension. The breaks between the fifth and sixth grades and between the eighth and ninth grades represent the three different tests.

Graphs III, IV, V, and VI represent four Berkeley schools illustrating varying conditions throughout the city. They show that in Berkeley as in other cities there is considerable variance of results in rate and comprehension of reading ability. These four graphs emphasize the fact that each school must meet and overcome problems distinctively its own.

For illustration:

It will be noted by Graph III that the Emerson School stands unusually high both in comprehension and in rate of reading. Furthermore, each succeeding grade improves gradually up to and including the sixth grade. The social and economic advantages unquestionably enter into the situation and bear out many of the statements made in this report.

Over and against these advantages we might cite Graph VI—the Hawthorne School. Although the fourth and fifth grades are very

TABLE I

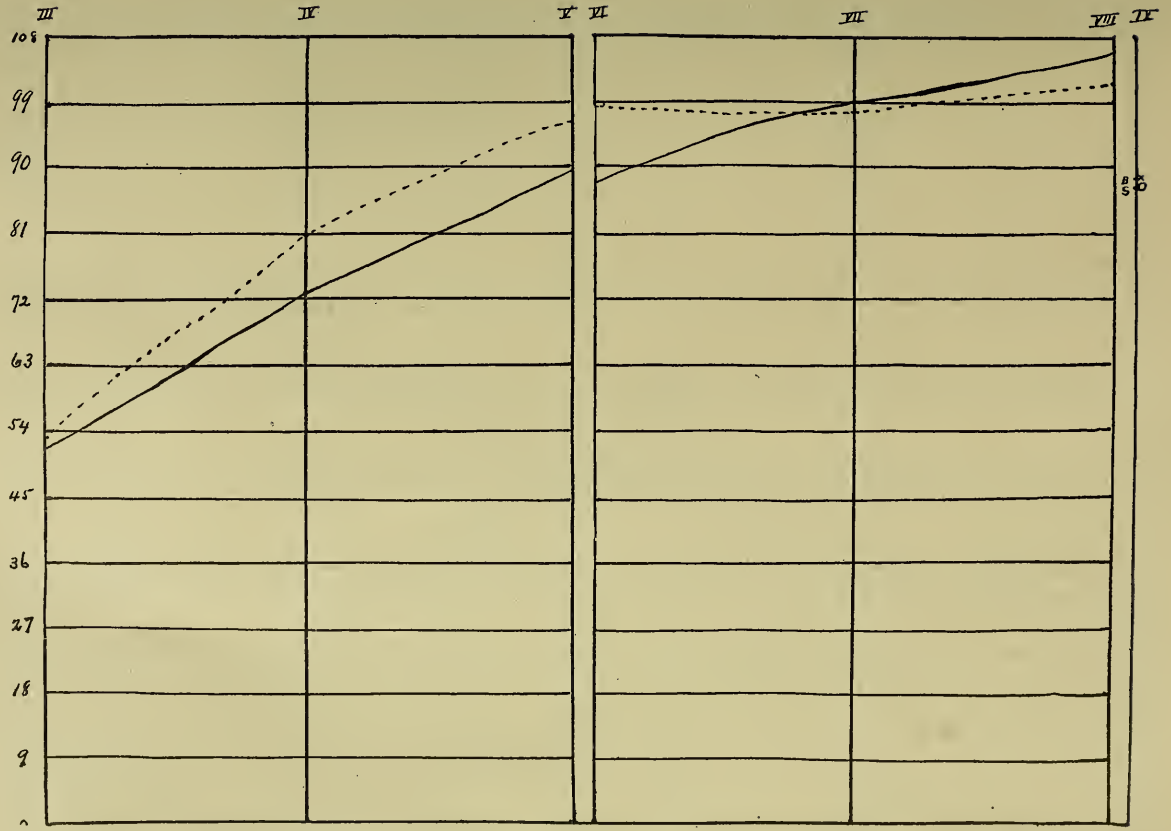
RATE OF READING—BERKELEY SCHOOLS

SCORE	3A	4B	4A	5B	5A	6B	6A	7B	7A	8B	8A	9B	9A
Above 160													
151 - 160						1						3	11
141 - 150	3	14	26	34	42	37	66	28	50	27	50	0	8
131 - 140	0	0	0	0	2	14	23	14	21	15	22	10	25
121 - 130	3	9	16	27	37	4	1	0	0	3	0	11	16
116 - 120	2	7	38	28	33	14	46	29	36	24	39	0	0
111 - 115	0	0	0	1	1	0	0	0	0	1	0	0	5
106 - 110	3	11	19	32	66	28	35	35	36	29	35	15	29
101 - 105	0	0	0	0	0	0	0	0	3	1	0	0	0
96 - 100	9	24	51	39	49	49	60	84	83	53	64	0	0
91 - 95	0	0	0	0	0	0	0	0	2	1	0	0	15
86 - 90	37	41	58	55	77	0	1	0	0	3	0	30	53
81 - 85	0	0	0	0	0	52	62	68	61	35	54	0	16
76 - 80	20	35	64	49	55	0	0	0	0	2	0	22	48
71 - 75	0	0	1	0	0	0	0	0	1	1	0	0	8
66 - 70	44	54	56	49	52	43	64	56	72	46	56	11	32
61 - 65	0	0	1	0	4	0	0	0	0	4	0	0	0
56 - 60	43	43	28	25	14	1	0	0	1	1	0	0	1
51 - 55	27	43	16	6	7	21	26	27	21	20	19	6	19
46 - 50	1	1	0	0	0	1	0	0	0	2	0	0	0
41 - 45	58	60	25	8	12	13	19	15	14	16	10	0	0
36 - 40	31	11	7	6	3	1	0	0	0	0	0	2	2
31 - 35	38	26	12	5	1	4	6	5	5	3	4	0	0
26 - 30	0	0	0	0	0	1	2	1	0	1	0	0	0
21 - 25	21	8	1	0	0	0	0	0	0	0	0	0	0
16 - 20	0	0	0	0	0	1	0	0	0	0	0	0	0
Below 15	23	12	5	3	0	1	0	1	1	0	0	0	0
Number	363	399	424	367	455	286	411	363	407	288	353	110	288
Median	53	60.5	80.72	89	96.3	96.46	98.16	97	97.5	96.89	101.3	88.41	87.74

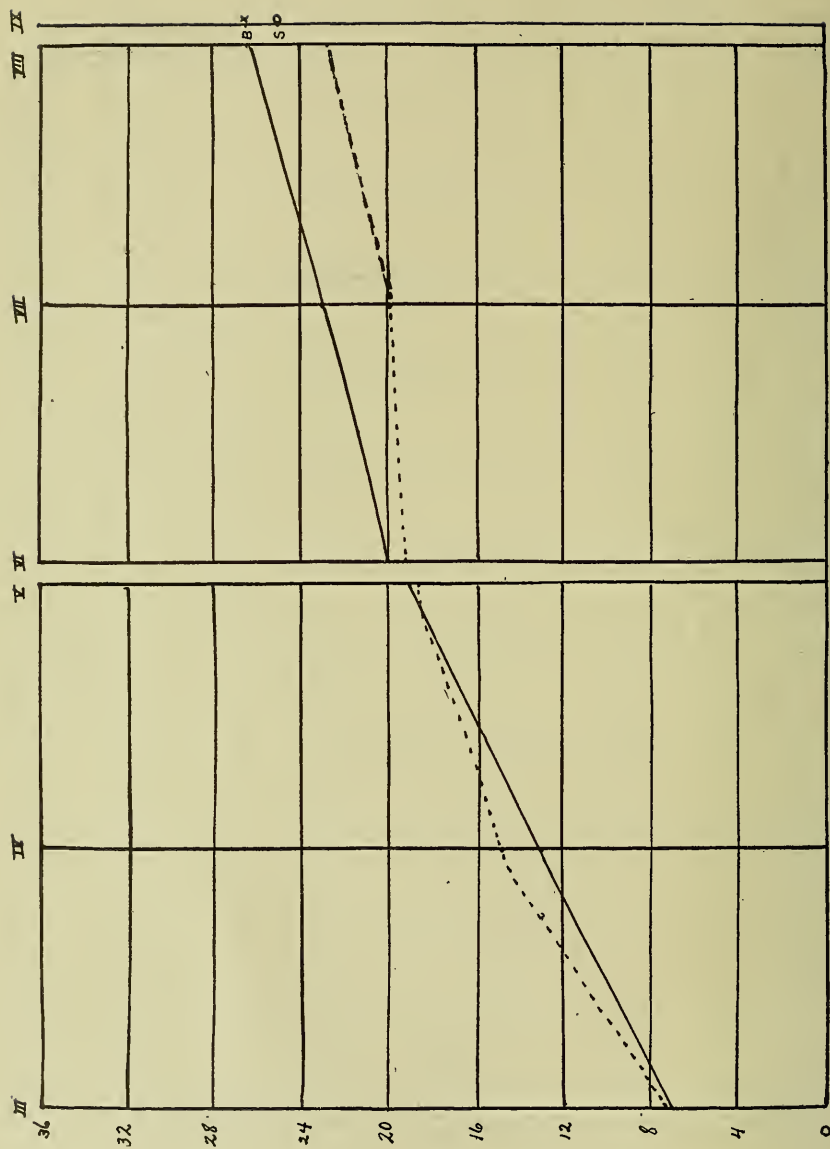
TABLE II

READING COMPREHENSION—BERKELEY SCHOOLS

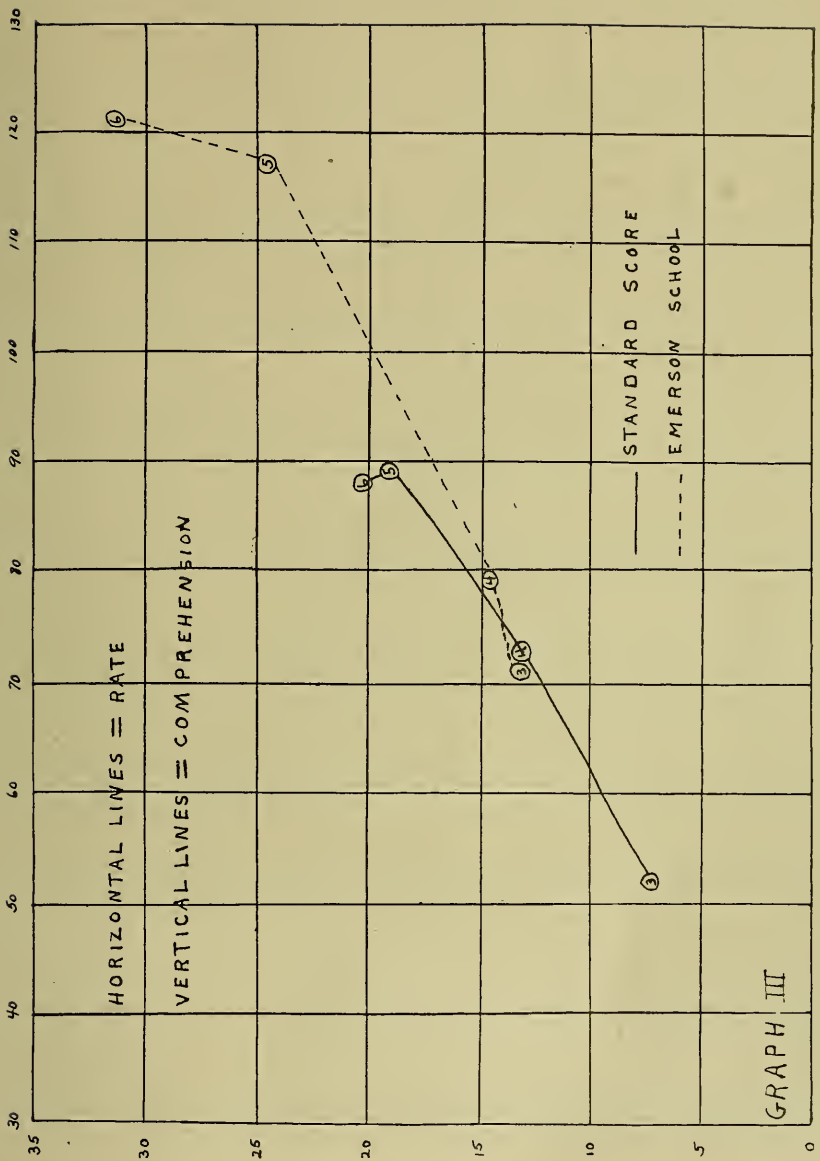
SCORE	3A	4B	4A	5B	5A	6B	6A	7B	7A	8B	8A	9B	9A
80 & above	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
70 - 79.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
60 - 69.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
50 - 59.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	7
45 - 49.9	.....	.....	.....	.....	.....	2	1	.....	5	2	6	5	12
40 - 44.9	.....	.....	.....	.....	.....	9	9	7	6	15	14	2	21
35 - 39.9	.....	.....	.....	2	.....	17	29	11	21	22	30	10	27
30 - 34.9	.....	4	5	17	13	18	41	23	32	18	24	14	39
27 - 29.9	3	10	20	19	36	12	25	24	29	25	34	12	31
24 - 26.9	2	10	26	29	44	23	31	36	46	22	57	19	38
21 - 23.9	5	18	30	48	73	26	36	41	43	34	27	12	50
18 - 20.9	11	23	45	47	76	42	58	54	56	56	77	4	9
15 - 17.9	20	30	69	45	62	43	80	49	68	42	36	14	31
13 - 14.9	21	37	51	59	51	26	30	36	33	21	23	3	7
11 - 12.9	25	52	51	36	42	23	24	40	32	15	16	6	9
9 - 10.9	52	38	42	30	25	18	18	16	15	9	4	1	1
7 - 8.9	49	53	18	12	12	10	11	9	7	4	2	5	2
5 - 6.9	83	67	33	11	18	9	10	8	6	2	3	0	2
4 - 4.9	14	13	8	4	3	6	4	3	6	1	0	0	0
3 - 3.9	33	12	9	2	0	1	0	0	0	0	0	0	1
2 - 2.9	12	13	9	4	0	1	3	4	1	0	0	0	0
1 - 1.9	10	13	4	2	0	0	0	0	0	0	0	0	0
0 - .9	21	6	6	0	0	0	1	2	1	0	0	0	0
Number	361	399	426	367	455	286	411	363	407	288	353	110	288
Median	7.3	10.2	14.9	16.6	18.6	18.46	19.29	18.8	19.8	20.7	22.7	25.66	26.56

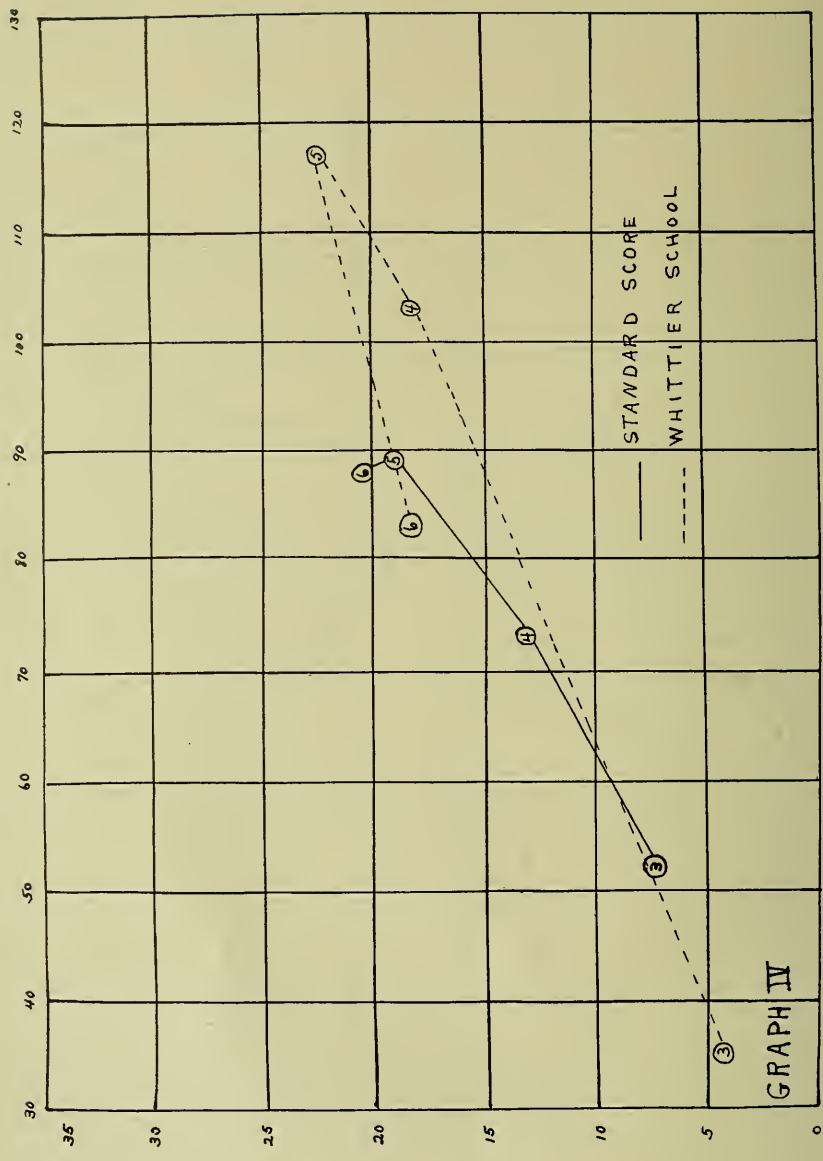


Graph I—Rate of reading—number of words per minute. ----- Berkeley.——— Standard.



Graph II—Reading comprehension. ------ Berkeley. ——— Standard.


HORIZONTAL LINES = RATE
VERTICAL LINES = COMPREHENSION
STANDARD SCORE
EMERSON SCHOOL
GRAPH III
130
120
110
100
90
80
70
60
50
40
30
35
30
25
20
15
10
5
0


STANDARD SCORE
WHITTIER SCHOOL
GRAPH IV
130
120
110
100
90
80
70
60
50
40
30
35
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25
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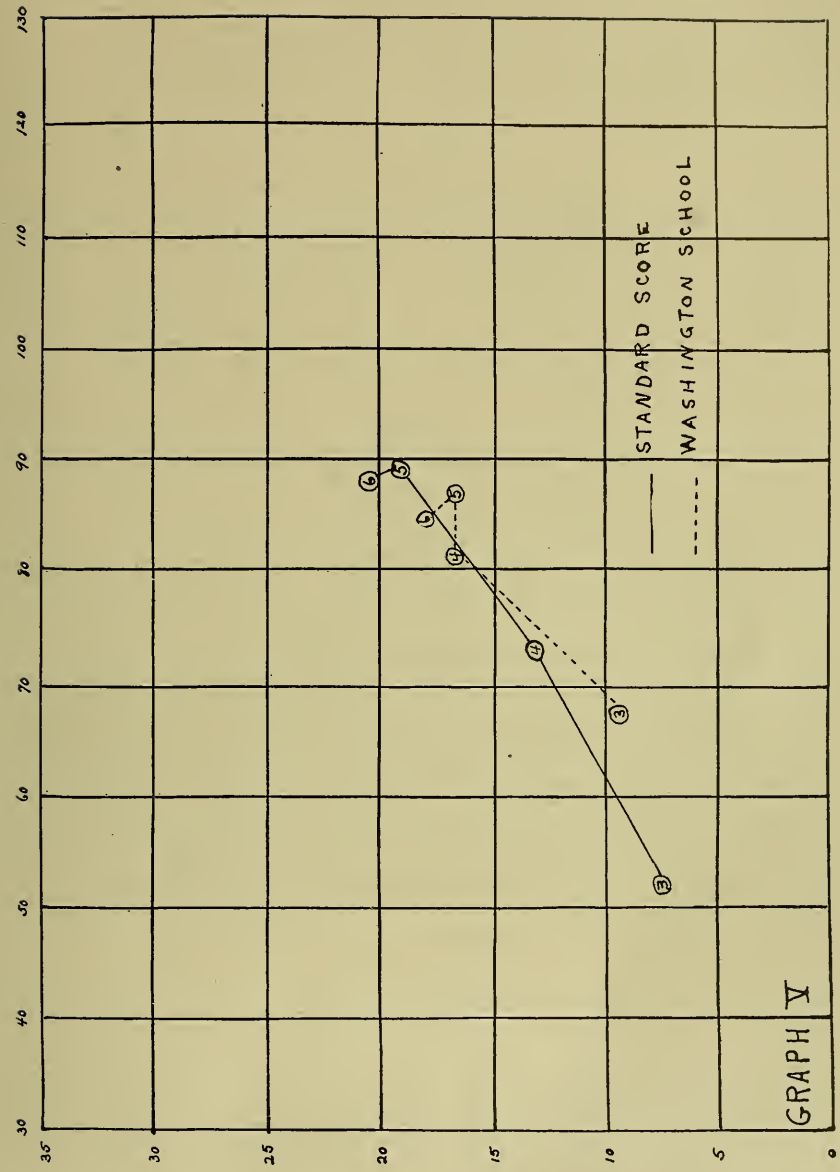
GRAPH V
STANDARD SCORE
WASHINGTON SCHOOL
130
120
110
100
90
80
70
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50
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25
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15
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5
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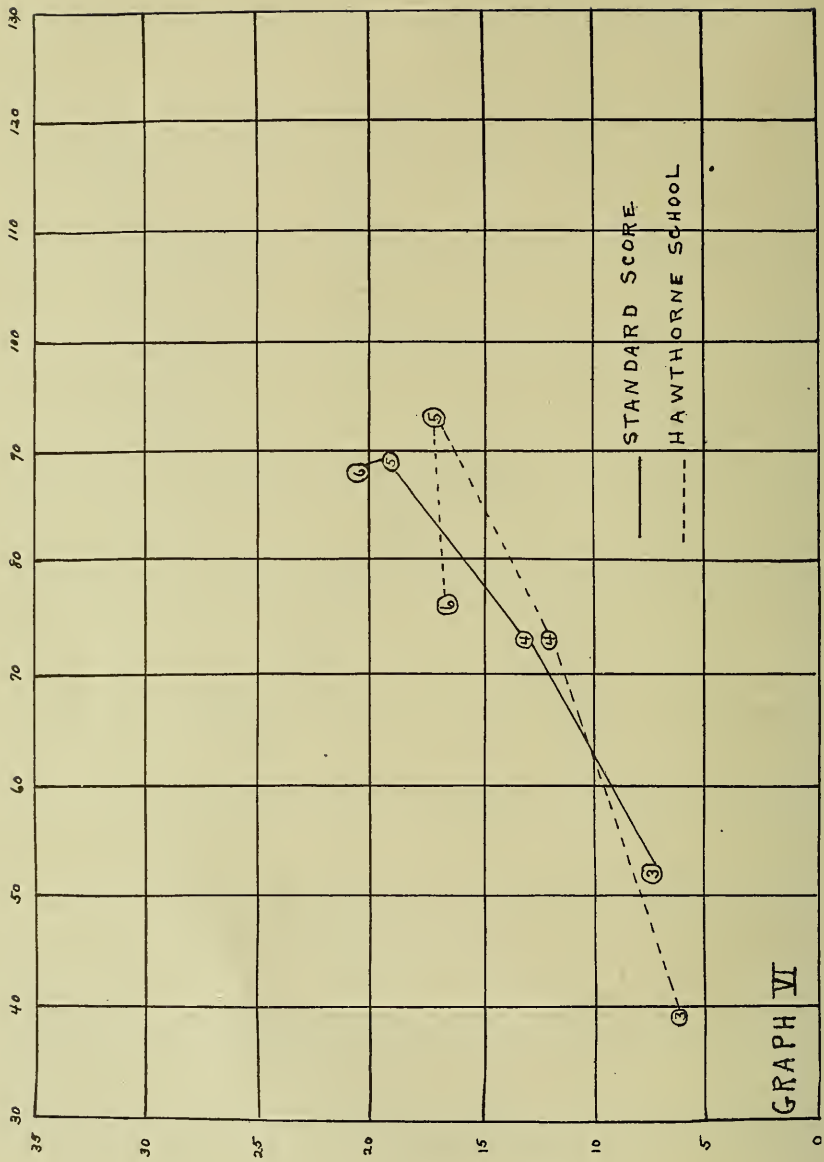
STANDARD SCORE
HAWTHORNE SCHOOL
GRAPH VI
130
120
110
100
90
80
70
60
50
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30
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25
20
15
10
5
0

near to the standard, it will be seen that, as compared to the Emerson School, the standing is considerably lower.

In Graph IV it will be noted that the third grade stands unusually low both in rate and comprehension. The fourth and fifth grades make rapid progress, especially in rate, while the sixth grade drops below the standard of the fifth grade. What may be the cause of this situation?

In Graph V—the Washington School—we have a still different situation. The third and fourth grades stand well, as compared with the standard, but the fifth and sixth grades show practically no gain either in rate or comprehension. This calls for a different solution from the others.

TABLE OF STANDARDS

GRADE	III	IV	V	VI	VII	VIII	IX
Rate	52	73	89	88	99	106	87
Comprehension	7.2	13	19	20	23	26.4	25

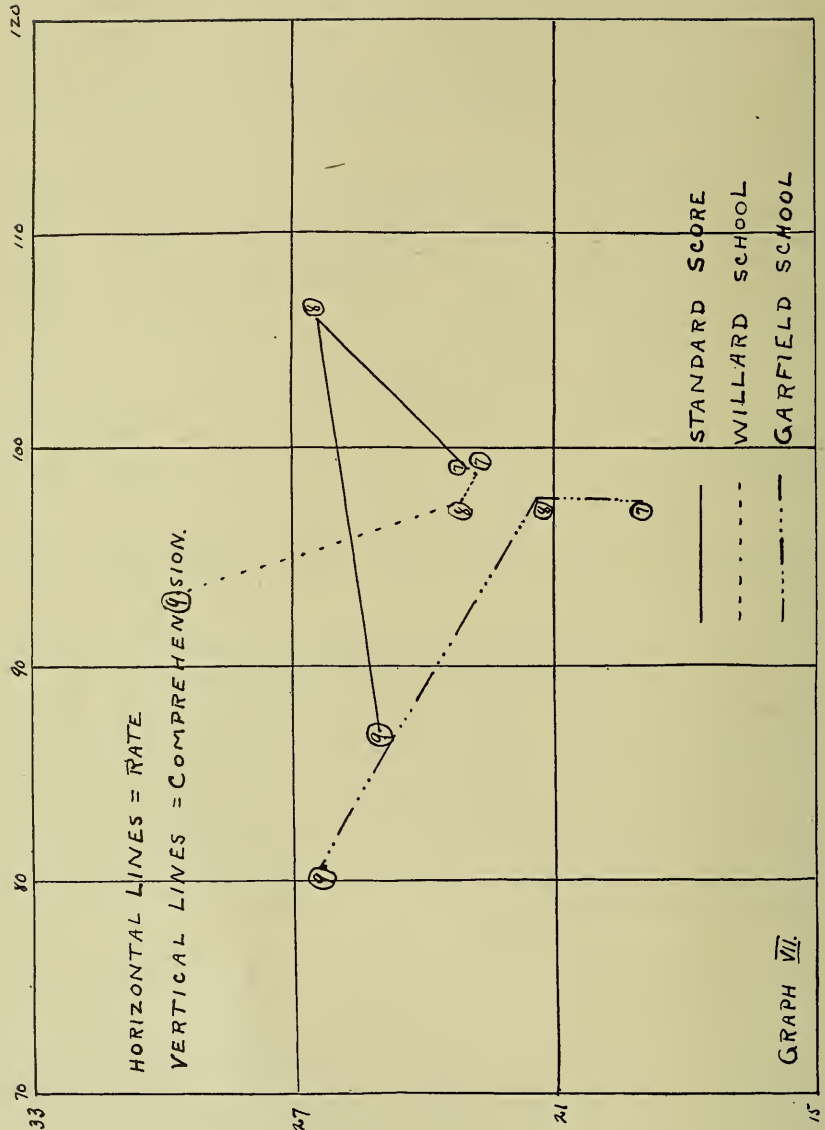
MEDIANS FOR BERKELEY.

Rate	53	80.7	96.3	98	97.5	101.3	87.7
Comprehension	7.3	14.9	18.6	19.2	19.8	22.7	26.5

Graph VII is a typical representation of the fact, generally true, not only in Berkeley but also in other cities, that a gain in rate of reading means a corresponding gain in reading comprehension. For illustration: Graph VII shows the seventh and eighth grades to be very near on a par with one another; their rate being practically the same and their comprehension increasing almost uniformly. The ninth grade of the Willard School, however, shows a decided increase in rate of reading over the Garfield School and the comprehension value improves in like proportion.

DISCLOSURES

A careful study of the results of the reading test in Berkeley discloses the fact that comprehension is sacrificed for rate throughout the fifth and sixth grades. This is very little, however. In the elementary grades—from the third through the sixth—there is a steady increase in reading rate over the standard for other cities, the highest point being reached in the sixth grade. In the seventh and eighth grades there is a drop, while again in the ninth grade Berkeley stands


33
27
21
15
70
80
90
100
110
120
HORIZONTAL LINES = RATE
VERTICAL LINES = COMPREHENSION.
STANDARD SCORE
WILLARD SCHOOL
GARFIELD SCHOOL

GRAPH VII.

a little above the standard.[1] In reading comprehension the third and fourth grades are above the standard while the fifth, sixth, seventh, and eighth grades show scarcely any improvement, being below the standard for other cities. The ninth grade, as in reading rate, stands above.

General Relation Between Rate and Comprehension

The prevailing opinion of the past has been that the slow, painstaking reader was also the more accurate reader in that he could understand better and reproduce more of the selection read than the rapid reader. Recent tests of large classes of children do not bear out this supposition. Often the rapid reader is the "good" reader and the slow reader is the "poor" reader. This is true of the Berkeley children as shown by the present tests. More frequently than otherwise there is a marked correlation between a high rate of speed in reading and a high comprehension score. There is of course an extremely rapid rate of reading, "skimming," which is beyond the normal rate of the child. This usually results in confusion and lack of comprehension.

Figure I given below is reproduced from the Report of the Cleveland Survey and shows what Judd found to be true concerning the rate and comprehension of 1831 pupils in silent reading as measured by Gray's Silent Reading Tests. On the basis of their scores these pupils were divided into nine groups as indicated in the figure. The per cent of the pupils in each group is indicated by the number within the circle. The size of the group is represented by the size of the circle. The figure shows that a rapid reader is more frequently good in quality (comprehension) than poor. The opposite is true of the slow reader.

Factors Influencing Rate and Comprehension

In a preceding paragraph it was pointed out that the rate score had reached the high-water mark in the sixth grade, being decidedly above the average. The comprehension score, however, shows that the fifth and sixth grades have fallen below the standard for other cities. It would seem, as was true in the Cleveland Survey, that in these grades rate was stressed at the expense of quality. It would be desirable if the rate could be maintained as it has been established, but unless the quality can be likewise brought up to a correspondingly high

[1] The reader must not confuse "standard" with the ideal. Standard in this case means simply what pupils "on the average" now do.

degree, the rate should be sacrificed. In the other grades the curves show that both rate and comprehension are emphasized equally; that as pupils read rapidly their power of comprehension is correspondingly high.

The Berkeley schools are organized on the six-three-three plan. The Intermediate schools comprise the seventh, eighth, and ninth grades and are operated on the regular High School plan. The break or gap that formerly existed between the eighth and ninth grades now, to some degree, exists between the elementary and intermediate grades. The committee is inclined to believe that the chief reason for the drop in rate and comprehension during the seventh and eighth grades is due largely to the change in method from that of the elementary schools. Here more attention is devoted to the mechanical construction, the

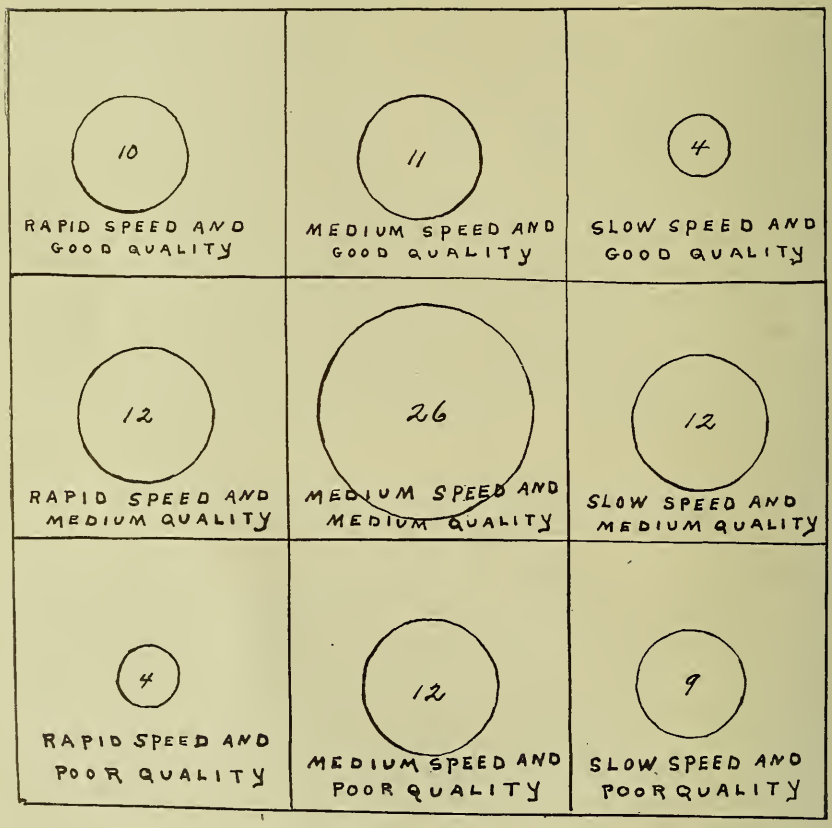


Fig. I—Per cent of 1831 Cleveland pupils found in each of nine speed and quality groups in silent reading. (From Judd's *Measuring the Work of the Public Schools.*)

introduction of the classics is frequently followed by a slower and more detailed study of structure, and a more general knowledge is expected from the pupils than was required in the preceding grades. The progress from the seventh through the eighth grade is steady and fairly comparable with the standard for the other cities and in the ninth grade is above the standard.

General Suggestions

The suggestions and general principles of method in reading given below are the conclusions drawn by William S. Gray from various scientific tests in reading. These appear in the Eighteenth Yearbook of the National Society for the Study of Education, 1919, Part II. (Public School Pub. Co., Bloomington, Illinois). They appeal to the committee as having unusual value and for that reason have been made a part of our report.

A. Growth Periods in the Development of Reading Ability.

1. Accomplishment in oral reading increases rapidly in the lower grades and steadily, but less rapidly, in the upper grades.
2. Rate of oral reading increases rapidly in the first three grades, and approximates a maximal rate in the fourth grade, excepting in the case of difficult passages.
3. Accuracy in the pronunciation of simple words increases rapidly in the lower grades. Longer and more difficult words present real difficulties throughout the upper grades.
4. Mastery of the mechanics of reading is frequently acquired more rapidly than the ability to comprehend the meaning of what is read.
5. Rate of silent reading increases rapidly in the lower grades and approximates a maximal rate in the upper grades.
6. The rate of silent reading surpasses the rate of oral reading between the second and fourth grades.
7. Ability to comprehend the meaning of what is read improves steadily throughout the grades.
8. Ability to comprehend simple statements of fact should be developed by the end of the third grade.
9. During the fourth, fifth, and sixth grades pupils should be taught to understand selections of increasing difficulty and they should be trained to utilize reading ability in a variety of ways.

B. Suggestions Relating to the Improvement of Rate of Reading.

1. Short exposure exercises are effective in improving the rate of reading in the lower grades.
2. Short exposure exercises, combined with training in rapid reading, are effective in increasing the rate of reading.
3. Speed drills increase the rate of reading, but do not change the effectiveness of reading to any large extent.
3. Skimming in reading increases the rate but may decrease markedly the comprehension of what is read.
5. Much reading of simple interesting material is effective in increasing the rate of reading.

C. Suggestions Relating to the Improvement of Comprehension.

1. Knowledge, while reading, that material is to be reproduced improves the quality of the reading.
2. Ability to reason and to make judgments concerning what is read are essential in effective silent reading.
3. Emphasis of the elements on which meaning depends improves comprehension.
4. Rapid readers usually read more effectively than slow readers.
5. For a given pupil the comprehension of what is read decreases as the rate of reading increases above his normal rate.

Suggestions Applicable to Berkeley

Since the Survey in Berkeley shows (*a*) that the reading in the earlier grades is, on the whole, satisfactory as compared with pupils in general, and (*b*) that in the upper grades it is below the standard, the following suggestions applicable to Berkeley are offered:

1. More instruction in silent reading should be given by thought-provoking and interpretive question. "Thorndike reaches the following conclusions after a careful, analytical study of the errors which pupils make in answering questions about what they have read: 'In school practice it appears likely that exercises in silent reading to find the answers to given questions, or to give a summary of the matter read, or to list the questions which it answers should in large measure replace oral reading. The vice of the poor reader is to say the words to himself without actively making judgments concerning what he reads.' "

2. Silent reading may profitably be given as early as the third grade, with some practice in the earlier grades.

3. Teachers would do well to discriminate between selections to be read orally and those to be read silently. There should be more instruction and practice in silent reading in the upper grades.

4. More reproduction, involving conclusions, should be required in order to strengthen comprehension.

5. All reproduction should be specific rather than general.

6. It is well to encourage speed; but comprehension should not be sacrificed to obtain it.

7. Constant effort should be made on the part of the teachers to increase the child's vocabulary.

8. Special care should be taken to build up the vocabulary of children whose parents are foreign born.

9. A branch of the Public Library should be established in each of the Intermediate Schools.

10. A sufficient number of interesting books should be provided for the school library.

11. Pupils who have access to few or no books at home should be especially encouraged to use the library, the teacher aiding the pupil in choosing such reading material as appeals to his native interests and lies within the scope of his reading comprehension.

12. Classics which require that the major part of the pupil's time be used in acquiring the pronunciation and meaning of words should be eliminated from the course of study.

13. Some attention should be given regularly to word analysis.

14. When a test shows that the scores of a class are widely distributed more individual instruction might be given with profit.

15. In the departmentalized schools the teachers of English should be trained to use the standardized tests. The regular teachers in the elementary schools might also be trained to use them with profit.

16. In every school we find some slow pupils and some whose home environment is a decided drawback. We also find in some of the Berkeley schools that the percentage of failures is very much greater than in others; this is especially true in the schools in which the foreign element predominates. The committee believes that special classes should be formed and a different course of study and of instruction should be planned to suit their capabilities.

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   (*c*) Fordyce's Scale for Measuring the Achievements in Reading. University Publishing Company, Lincoln, Nebraska.
   (*d*) Gray's Silent Reading Tests. Wm. S. Gray, School of Education, University of Chicago, Chicago, Illinois.
   (*e*) Also, Gray's Oral Reading Test. Same address.
   (*f*) The Kansas Silent Reading Tests, devised by F. J. Kelley, Bureau of Educational Measurements and Standards, Emporia, Kansas. Test 1 is for grades III, IV, and V; Test II, for grades VI, VII, and VIII; Test III, for grades IX, X, XI, and XII.
   (*g*) The Minnesota Scale Beta. Bureau of Coöperative Research, University of Minnesota, Minneapolis, Minnesota.
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   (*i*) Starch's Silent Reading Tests. Daniel Starch, University of Wisconsin, Madison, Wisconsin.
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CHAPTER IV

REPORT OF THE COMMITTEE ON THE FUNDAMENTALS OF ARITHMETIC

Introduction

Even though it is no longer thought that proficiency in abstract number work is all or even the most important part of arithmetic, it is still conceded that the ability required to perform the operations of addition, subtraction, multiplication, and division is fundamental in making arithmetic one of the working tools of every day living. It should be the aim of common school education to make these four processes so automatic in a limited time that they may be performed with accuracy and rapidity. This acquired efficiency will then allow more of the pupils' attention and time to be devoted to the real problems of arithmetic.

The fifth and last series of tests to be given in connection with the seminar survey of the Berkeley Public Schools were the Courtis Standard Research Tests, Series B, in the fundamentals of arithmetic. These were given on May 8th and 9th, during the twenty-fifth week of the school year. A total of 3900 children, including all the pupils in the 135 classes in grades four to eight, were tested.

The Courtis Arithmetic Tests have undoubtedly been the most widely used of any designed for the measurement of ability in the fundamental processes. As a result, we have in connection with them the best comparative standards. The one used in this report is called the "general standard," and consists of medians given by Courtis and based upon distributions of many thousands of individual scores in tests given in May or June, 1915–1916 (see Bulletin 4, Courtis Standard Research Tests). These general standards include the results obtained from equal numbers of classes from large city schools and from small city and country schools. Courtis has proposed another standard with a lower rate (speed), in general for lower grades, and 100 per cent accuracy. This standard is the ideal toward which our school work is properly directed, but it is not the one generally used for comparative purposes.

The committee has spent not less than a total of one hundred and fifty hours in connection with the work of compiling this report. The computations, more than 2000 in number, were all checked and in many instances rechecked to guard against mistakes.

Planning and Giving Tests

The following directions were sent to every teacher in the Berkeley department several days preceding the day set for the test and were followed in detail:

THE PUBLIC SCHOOLS
Berkeley, California

Bulletin No. 54.
May 3, 1919.

Directions for Giving Tests in the Fundamentals of Arithmetic

To Principals and Teachers:

The tests in the four fundamental processes of arithmetic will be given to classes from the fourth to the eighth grades inclusive during the afternoons of May 8 and 9. A representative of Professor Mead's seminar will be at your school some time during the morning at a time which may be arranged by telephone, in order to distribute the material and assist the teachers in interpreting the directions for giving and scoring the tests. See that the directions are followed implicitly. The time limits should be watched very carefully. Principals will please make the necessary arrangements for the representative to meet the teachers in group. This will be the last test.

Directions for Giving and Scoring the Tests

1. For each room, prepare as many bundles of papers as there are rows of seats, putting into each bundle as many papers as there are seats in each row.

2. Begin by saying: "My purpose this morning is to measure how well you can add, subtract, multiply, and divide. I have here some printed tests. They are not examinations, because exactly these same tests have been given to all the grades from the third through high school. If you treat the tests as though they were a game, you will enjoy them. Do your best for the honor of your school. I am going to give each of you a set of these papers, but do not examine them until I tell you to do so. Will the boys and girls in the front seats please distribute them for me?"

3. Distribute the papers by putting a bundle on the first desk in each row and letting the children do the rest.

4. Have the children fill out the blanks at the bottom of the first page. Write the date in figures, and the time to the nearest half hour; thus, 9–25–1913–10:30.

5. Have the children read instructions for Test 1 out loud in concert.

6. "Now please listen closely. In these tests it is important that we all start at the same time and stop at the same time. We can do this easily, if you follow my instructions exactly. Lay your papers on your desks in position to work the examples. Take your pencils in your right hand, and when I say 'Get ready,' raise your pencil hand in the air as if you were going to ask a question. (Illustrate by suiting the action to the words.) Do not look at the tests, but watch me. Then when I say 'Start,' you can bring your pencil down, and every one will start at the same time. When I say 'Stop,' I want you all to stop at once, and to raise your hands again so that I can see that you have stopped. Now I think we are ready to try the test."

When the second hand of the watch reaches the 55 second mark say: "Get ready for the Addition Test. Hands up. Eyes this way." Exactly at the 60 mark say "Start." (It is well to add the number of minutes to the time of starting, writing it down.)

Allow Exactly Eight Minutes

"Stop. Hands up." Make sure all have stopped. "Count how many examples you have finished, and write the number in the score card in the corner under the number attempted. Do not count examples you have begun but have not finished. Your score is the number of the examples you have finished. I am coming to your desk to see that you have written it in the right place."[2]

7. Read the answers from an Answer Card (be sure the form number corresponds with that of the tests), and have children check answers right (this means each digit) or wrong, counting the number right, and writing it in their score cards.

8. In similar fashion give and score the other tests. For Test 2, Subtraction, *allow exactly four minutes;* for Test 3, Multiplication, *allow exactly six minutes;* for Test 4, Division, *allow exactly eight minutes.*

9. Give Tests 1 and 2 the first day, and Tests 3 and 4 the next. All may be given at one time if desired. (Watch the time limits.)

10. The teacher should rescore all papers having exceptionally low or high scores. Mark I. N. F. (Instructions not followed) all papers where the children have used the wrong operation (addition for multiplication, etc.).

11. Tie all papers into a compact bundle, include the Answer Card, and send same to the Principal, who will send the test sheets to the Superintendent's office by Saturday, May 10th.

Very truly yours,

H. B. Wilson,
Superintendent of Schools.

Oral Instructions

These oral instructions were given to the teachers by the representatives:

1. Give the tests any time Thursday or Friday.
2. Under direction (5) ask the children if there are any questions. Test them as to whether they understand the instructions.
3. Keep B and A sections separate.
4. Be sure that on the second day each pupil gets his own paper.

Collection and Assembling of Data

When the tests were given, the papers were corrected by the children and checked by the teachers according to directions. Members of the Seminar recorded the results for the schools which they represented on the Class Record blanks. These were then taken in charge by the committee, who assembled the results, finding the median of attempts, accuracy and rights for each grade, as given in the following tables and graphs.

Explanation of Tables and Graphs

The tables I, II, III, and IV give the median score in the number of examples attempted, and the number found right in each grade tested. The standard is placed at the top of the page for comparative purposes. At the bottom of the page is the average score attained by each grade in Berkeley. Table V compares the number of examples attempted, the accuracy and the rights of each grade of Berkeley with the standard for corresponding grades, in each of the four processes.

Graph I is a graph showing the average of Berkeley medians in comparison with the standard medians for speed and accuracy in addition. For this graph we have used the Courtis sheet, which is self-explanatory. Graphs II, III, and IV are similar charts for subtraction, multiplication, and division.

Graphs V and VI are a comparison of Berkeley rights and standard rights. Rights are obtained by multiplying speed by accuracy. The

Table I—Addition

GRADE	4B		4A		5B		5A		6B		6A		7B		7A		8B		8A	
	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.
Standard	A & B COMBINED		7.4	4.7			8.6	6.0			9.8	7.2			10.9	8.2			11.6	8.8
Columbus	6.87	3.8	8.14	5.4	8.75	6.1	9.5	5.7	9.	6.3	10.	7.6								
Emerson	8.5	6.2	8.75	6.5	7.25	4.8	8.	5.5	11.37	7.6	10.27	7.4								
Franklin	5.2	2.8	7.8	4.7	6.57	4.2	6.25	4.7	6.5	4.6	7.12	4.								
Hawthorne	8.3	5.8	6.5	3.8	8.	5.9	9.16	6.9	10.6	8.2	10.5	8.9								
Hillside	4.75	2.6	5.5	3.	5.8	4.9	6.5	4.3												
Jefferson	7.	3.7	8.37	5.	8.6	5.6	8.62	5.5	11.	8.3	11.83	9.9								
John Muir	5.33	3.2	6.7	4.2	8.2	5.3	8.	5.6	8.6	6.9	7.6	4.6								
	4.75	2.6																		
LeConte	7.12	4.	7.	4.	8.	6.6	8.7	5.7	6.7	4.2	8.1	5.7								
Lincoln	6.75	3.6	8.3	4.8	10.2	7.	10.	7.1	12.	9.3	12.8	9.6								
*Longfellow	7.25	3.9	8.14	4.7	8.	4.8	9.44	7.	9.66	7.7	9.77	8.6								
McKinley	9.33	6.5	7.75	5.8	8.5	6.	8.75	6.1	10.66	8.5	9.66	7.3								
Oxford	3.71	1.3	6.5	3.3	6.25	3.4	6.33	3.2	8.5	6.	8.7	7.6								
					8.3	6.6														
Thousand Oaks	4.2	1.5	7.	3.5	8.25	5.6			7.5	4.1	9.	5.9								
Washington	5.	3.3	7.36	4.2	8.07	4.7	7.4	4.7	7.9	5.8	8.71	5.7								
	5.6	3.5					8.81	6.2												
Whittier	7.	3.9	8.88	5.2	6.67	3.5	9.57	6.1	10.5	7.4	9.17	7.2								
*Burbank													7.75	5.7	9.42	6.6	9.62	6.	10.75	7.5
													8.	5.5	8.2	5.5				
Edison													9.5	4.4	7.85	5.	13.	9.5	10.66	6.7
													11.	7.3	10.	6.7	11.25	7.9	11.16	8.3
													9.1	5.7	9.25	5.4	10.	6.	10.	8.1
Garfield													9.1	6.8	10.	7.1	10.28	8.2	10.	7.3
													10.	7.5	9.4	6.4	10.8	8.8	9.5	6.8
													9.2	6.1	9.3	7.1				
Willard													11.3	9.	11.75	9.1	9.75	8.3	8.44	6.2
													7.66	4.8	9.3	6.3	10.83	7.6	9.44	7.8
															9.	6.7			9.25	7.2
															9.33	7.1				
															9.2	6.4				
Avg. of Medians	6.27	3.7	7.5	4.5	7.8	5.3	8.3	5.6	9.3	6.8	9.5	7.1	9.3	6.3	9.4	6.6	10.7	7.8	9.9	7.3

*Longfellow Ungraded 6.5 2.7 *Burbank Ungraded 7.5 5.3

GRADE	4B		4A		5B		5A		6B		6A		7B		7A		8B		8A	
	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.
Standard	A & B COMBINED		7.4	5.9			9.	7.5			10.3	8.8			11.6	10.			12.9	11.2
Columbus	4.6	2.1	7.8	6.5	8.33	6.4	9.66	6.8	10.62	9.	12.6	10.6								
Emerson	5.85	4.9	8.75	6.7	7.85	6.8	8.2	6.8	10.4	8.8	13.33	11.3								
Franklin	4.6	2.3	5.44	2.5	6.33	5.2	8.75	6.3	7.	5.5	8.55	7.								
Hawthorne	7.77	5.4	8.	6.	11.5	11.5	11.	11.	15.	15.	12.6	12.6								
Hillside	4.5	2.6	5.5	4.2	4.8	4.8	5.25	4.2												
Jefferson	5.54	1.8	8.	5.3	9.	7.7	9.2	7.6	11.6	11.1	14.	13.2								
John Muir	4.2	1.3	6.33	4.1	8.5	7.	8.55	5.1	8.	6.7	8.66	6.9								
	4.5	2.4																		
LeConte	5.3	3.2	8.4	6.7	7.	5.8	9.	8.3	8.25	7.	10.	8.5								
Lincoln	5.42	2.8	7.28	4.8	9.25	8.1	9.5	7.7	11.83	10.1	12.33	11.4								
*Longfellow	6.2	4.3	7.2	4.3	9.5	7.1	12.	9.7	12.	10.6	10.33	10.3								
McKinley	9.	6.9	6.25	4.4	8.33	6.9	9.44	8.2	11.83	10.4	10.1	8.6								
Oxford	3.8	1.2	6.28	2.9	7.	4.7	7.66	5.7	9.	7.	9.33	8.4								
					8.	5.6														
Thousand Oaks	4.	1.2	7.	5.6	9.	7.2			10.	8.	12.5	7.5								
Washington	4.71	3.3	5.36	4.1	6.42	5.2	7.33	6.	9.	7.6	9.75	8.2								
	5.87	4.4					9.5	8.												
Whittier	4.83	3.4	9.	7.4	7.63	5.2	8.17	5.4	11.17	10.2	9.6	8.3								
*Burbank													10.6	9.2	11.5	9.3	13.6	12.8	13.5	13.
													7.25	5.9	11.2	10.2				
Edison													12.33	10.7	12.66	11.3	14.	12.3	16.	14.4
													13.	10.4	10.6	8.5	12.75	11.5	15.5	14.
													9.6	7.8	9.6	7.7	18.	16.5	15.	12.5
Garfield													12.5	10.5	10.8	8.9	14.	13.1	14.2	12.9
													12.25	11.	14.25	12.3	14.6	12.6	14.2	12.1
													11.5	10.6	12.8	11.5				
Willard													9.	7.6	12.75	11.6	12.	11.5	13.4	12.5
													11.83	10.5	12.	10.7	16.5	15.3	14.	12.9
															13.6	11.7			12.66	11.9
															10.7	8.7				
															16.83	15.4				
Avg. of Medians	5.3	3.1	7.1	5.	8.	6.6	8.9	7.1	10.4	9.1	11.	9.5	11.	9.4	12.3	10.6	14.4	13.2	14.3	12.9

*Longfellow Ungraded 8. 4.4 *Burbank Ungraded 10. 7.5

TABLE III—MULTIPLICATON

GRADE	4B		4A		5B		5A		6B		6A		7B		7A		8B		8A	
	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.
Standard	A & B COMBINED		6.2	4.2			7.5	5.6			9.1	7.1			10.2	8.2			11.5	9.3
Columbus	4.16	2.1	6.12	4.1	7.09	4.5	7.42	4.6	7.6	4.2	10.42	8.3								
Emerson			8.66	6.8	5.9	4.7	5.14	4.	7.	5.3	7.66	5.7								
Franklin	2.63	.8	6.28	4.2	5.66	3.7	6.55	5.2	5.7	3.8	7.7	6.4								
Hawthorne	2.76	1.6	4.75	3.5	9.66	7.7	10.	7.6	11.	8.3	10.	9.								
Hillside	2.	.6	2.75	1.5	3.57	2.1	4.67	3.												
Jefferson	2.77	1.4	5.6	4.1	6.	5.1	6.75	4.5	9.	8.1	9.6	8.								
John Muir	1.83	.9	5.38	4.5	3.33	1.8	6.25	4.2	6.37	5.4	7.	5.7								
	2.5	1.																		
LeConte	3.5	1.8	4.16	2.6	5.37	4.7	6.33	3.8	5.57	3.8	6.8	5.								
Lincoln	2.12	.6	3.6	2.	6.25	5.2	6.93	5.2	9.2	7.2	9.83	7.8								
*Longfellow	3.28	1.	5.	3.	6.	4.2	9.57	7.9	11.5	9.9	8.16	7.2								
McKinley	5.33	3.7	5.1	4.4	7.5	6.3	7.71	6.6	8.	6.4	8.5	7.								
Oxford	1.67	.7	3.8	1.5	5.	3.	5.6	2.1	7.	5.6	6.8	6.								
					5.	4.														
Thousand Oaks			4.	2.5	7.16	5.7			7.6	4.6	9.	5.9								
Washington	1.42	.4	4.38	2.6	6.2	4.	5.75	4.	7.85	6.4	9.	7.3								
	2.25	.8					6.92	5.8												
Whittier	1.85	.5	5.87	4.	5.61	4.	9.88	7.6	8.33	6.9	7.6	6.4								
*Burbank													7.11	5.2	8.75	6.5	10.2	8.2	9.37	7.3
													7.5	5.2	9.4	7.5				
Edison													9.14	6.7	10.16	7.4	10.	8.	15.6	12.9
													7.7	5.2	9.14	6.	6.83	5.2	9.7	8.2
													6.9	4.3	7.37	4.4	10.5	8.2	11.25	9.2
Garfield													8.3	6.5	10.	8.2	10.85	9.6	11.1	9.8
													8.	6.6	9.3	7.6	12.	10.1	12.6	9.9
													9.	7.6	10.09	8.1				
Willard													7.33	6.	7.6	6.4	10.16	8.8	14.3	12.7
													10.46	9.	9.12	7.8	10.83	9.9	11.	9.2
															8.6	7.1			12.	10.2
															9.38	7.7				
															10.1	8.6				
Avg. of Medians	2.67	1.2	5.03	3.4	5.96	4.4	7.03	5.1	7.98	6.1	8.43	6.8	8.14	6.2	9.15	7.2	10.17	8.5	11.88	9.9

*Longfellow Ungraded 4. 2.5 *Burbank Ungraded 7.25 3.1

TABLE IV—DIVISION

GRADE	4B		4A		5B		5A		6B		6A		7B		7A		8B		8A	
	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.	At.	R.
Standard	A & B COMBINED		4.6	2.6			6.1	4.7			8.2	7.1			9.6	8.6			10.7	9.7
Columbus					4.75	2.1	5.75	2.	5.25	2.6	8.28	7.								
Emerson					4.63	3.2	4.46	3.5	7.25	6.1	7.5	6.5								
Franklin					3.6	1.6	3.87	2.5	4.25	3.	5.25	3.6								
Hawthorne					7.	4.6	6.4	4.	11.6	9.9	10.	8.6								
Hillside					3.	1.3	2.75	1.4												
Jefferson					5.	1.9	4.62	2.5	8.	7.6	8.75	8.3								
John Muir					3.4	2.	4.	2.8	5.16	4.3	6.	4.8								
LeConte					5.	4.1	5.2	2.9	4.6	3.	5.75	4.9								
Lincoln					5.33	3.5	5.47	3.7	8.87	7.7	11.6	9.9								
*Longfellow					3.75	1.9	9.44	6.8	8.33	8.3	8.33	7.4								
McKinley					6.2	4.3	7.	6.7	6.4	5.2	7.83	7.4								
Oxford					4.	2.	4.11	1.6	5.55	4.4	5.54	4.7								
					4.	2.2														
Thousand Oaks					6.4	3.8			6.5	4.6	9.	7.2								
Washington					4.53	2.6	4.8	3.2	7.5	6.5	8.5	7.6								
							5.66	4.9												
Whittier					4.25	2.8	6.39	4.6	7.	5.7	6.22	5.4								
*Burbank													7.83	6.4	8.25	7.3	9.	7.8	8.44	7.2
													5.77	4.4	6.6	4.8				
Edison													9.	8.1	9.25	8.3	11.	10.56	12.	11.6
													7.2	6.2	6.75	5.3	10.	9.7	11.3	11.3
													6.7	5.2	6.4	4.8	8.5	7.2	10.	9.3
Garfield													8.	6.8	8.	8.	11.5	11.5	10.87	10.8
													6.5	5.7	9.5	8.1	10.8	10.1	11.6	11.1
													8.	7.4	8.6	8.6				
Willard													6.2	5.2	8.6	8.6	13.1	13.1	12.5	12.5
													7.7	6.1	9.6	9.6	12.5	12.5	11.7	11.7
															8.5	8.1			10.77	10.6
															9.	9.				
															12.	12.				
Avg. of Medians					4.7	2.7	5.3	3.5	6.9	5.6	7.8	6.7	7.3	6.2	8.5	7.9	10.8	10.3	11.	10.7

*Longfellow Ungraded 3.3 .9 *Burbank Ungraded 5.24 3.9

result is really the median of correct examples for each grade. By this and Graphs VII and VIII it can be more clearly noted where Berkeley falls above or below the standard.

Graphs IX and X, and XI and XII, show the range between the highest and lowest score reached in each grade, and also the variation from the standard.

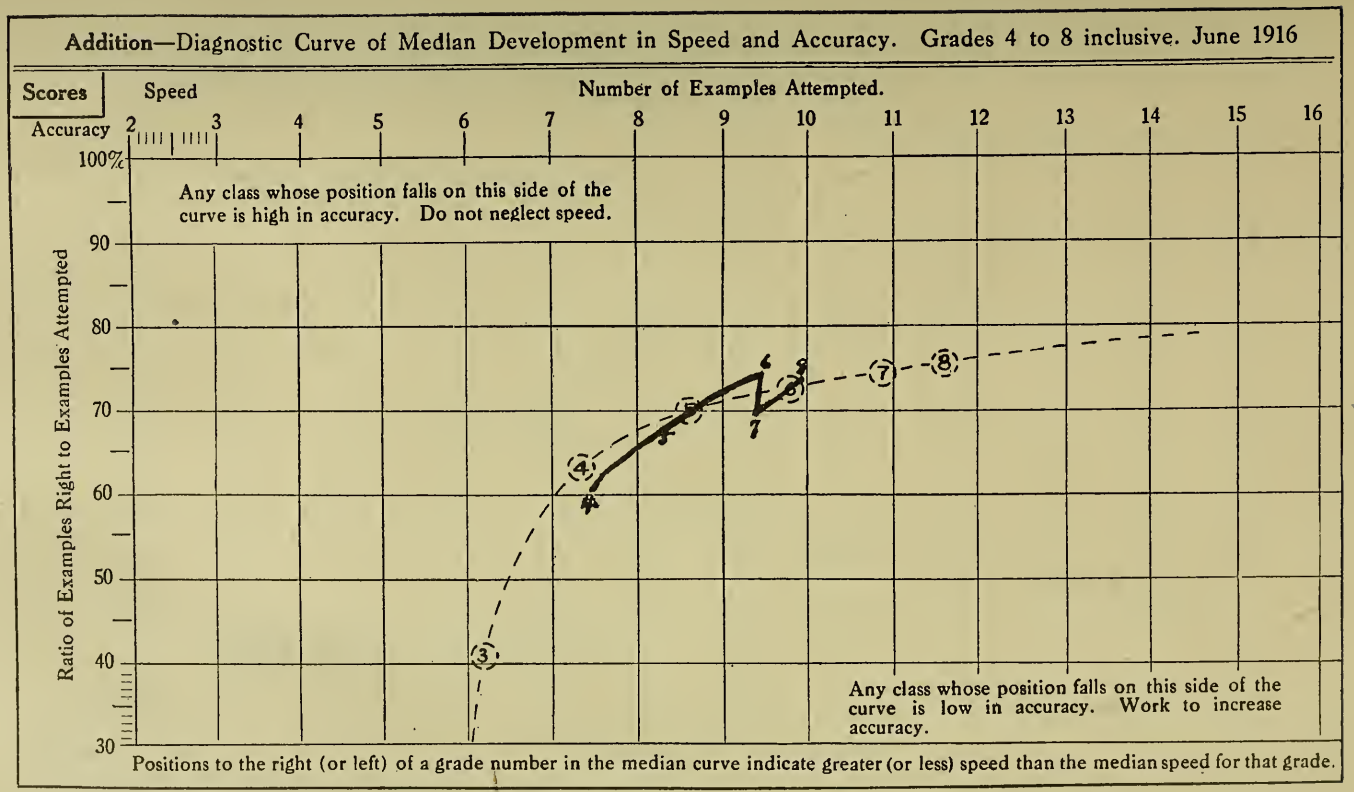
TABLE V

	ADDITION							SUBTRACTION						
	Standard			Berkeley				Standard			Berkeley			
Grade	Att.	Acc.	Rts.	Att.	Acc.	Rts.	Grade	Att.	Acc.	Rts.	Att.	Acc.	Rts.
4	7.4	64	4.7	7.5	60.1	4.5	4	7.4	80	5.9	7.1	69.9	5
5	8.6	70	6	8.3	67.2	5.6	5	9	83	7.5	8.9	79.8	7.1
6	9.8	73	7.2	9.5	74.2	7.1	6	10.3	85	8.8	11	85.5	9.5
7	10.9	75	8.2	9.4	69.8	6.6	7	11.6	86	10	12.3	86.1	10.6
8	11.6	76	8.8	9.9	74.1	7.3	8	12.9	87	11.2	14.3	90.5	12.9

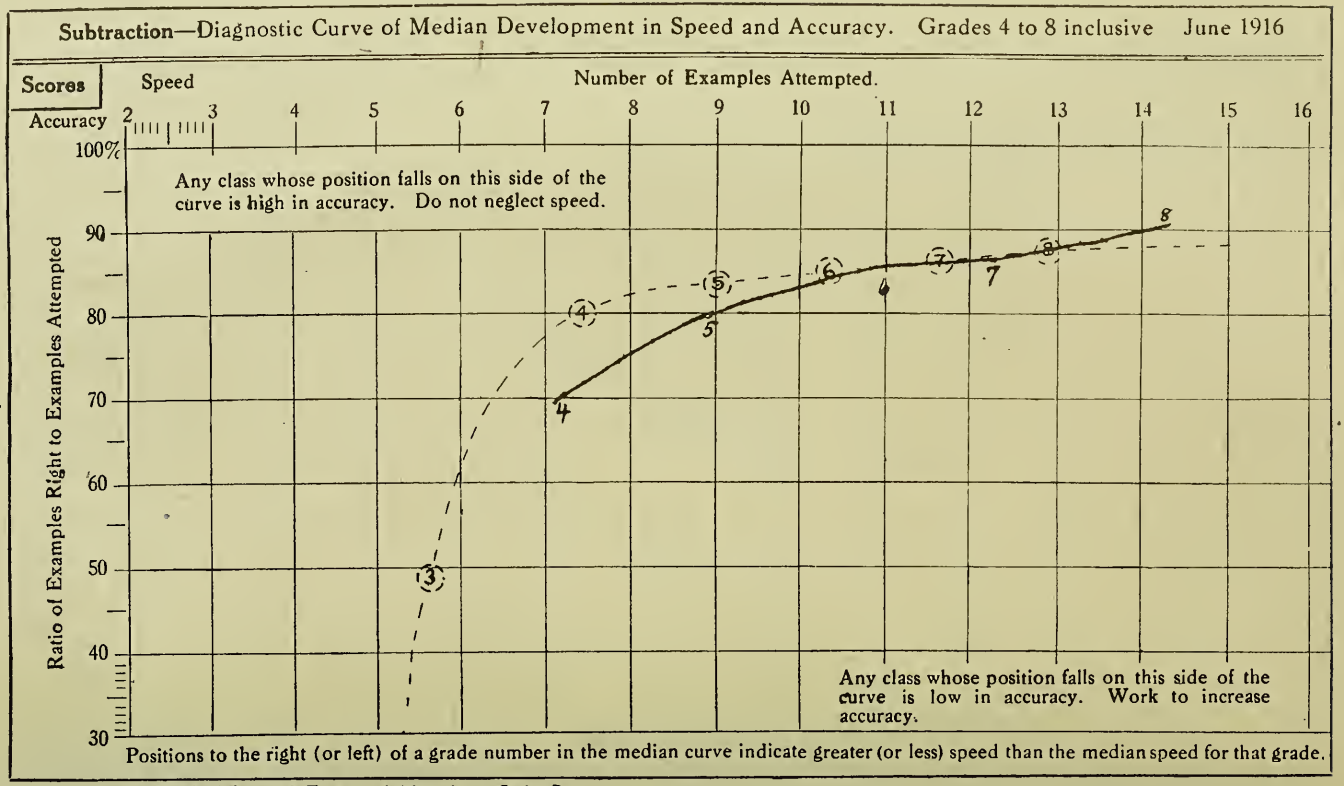
	MULTIPLICATION							DIVISION						
Grade	Att.	Acc.	Rts.	Att.	Acc	Rts.	Grade	Att.	Acc.	Rts.	Att.	Acc.	Rts.
4	6.2	67	4.2	5	65.9	3.4							
5	7.5	75	5.6	7	71.2	5.1	5	6.1	77	4.7	5.3	64.8	3.5
6	9.1	78	7.1	8.4	81	6.8	6	8.2	87	7.1	7.8	85.4	6.7
7	10.2	80	8.2	9.2	78.2	7.2	7	9.6	90	8.6	8.5	91	7.9
8	11.5	81	9.3	11.9	83.4	9.9	8	10.7	91	9.7	11	95.8	10.7

INTERPRETATION OF RESULTS

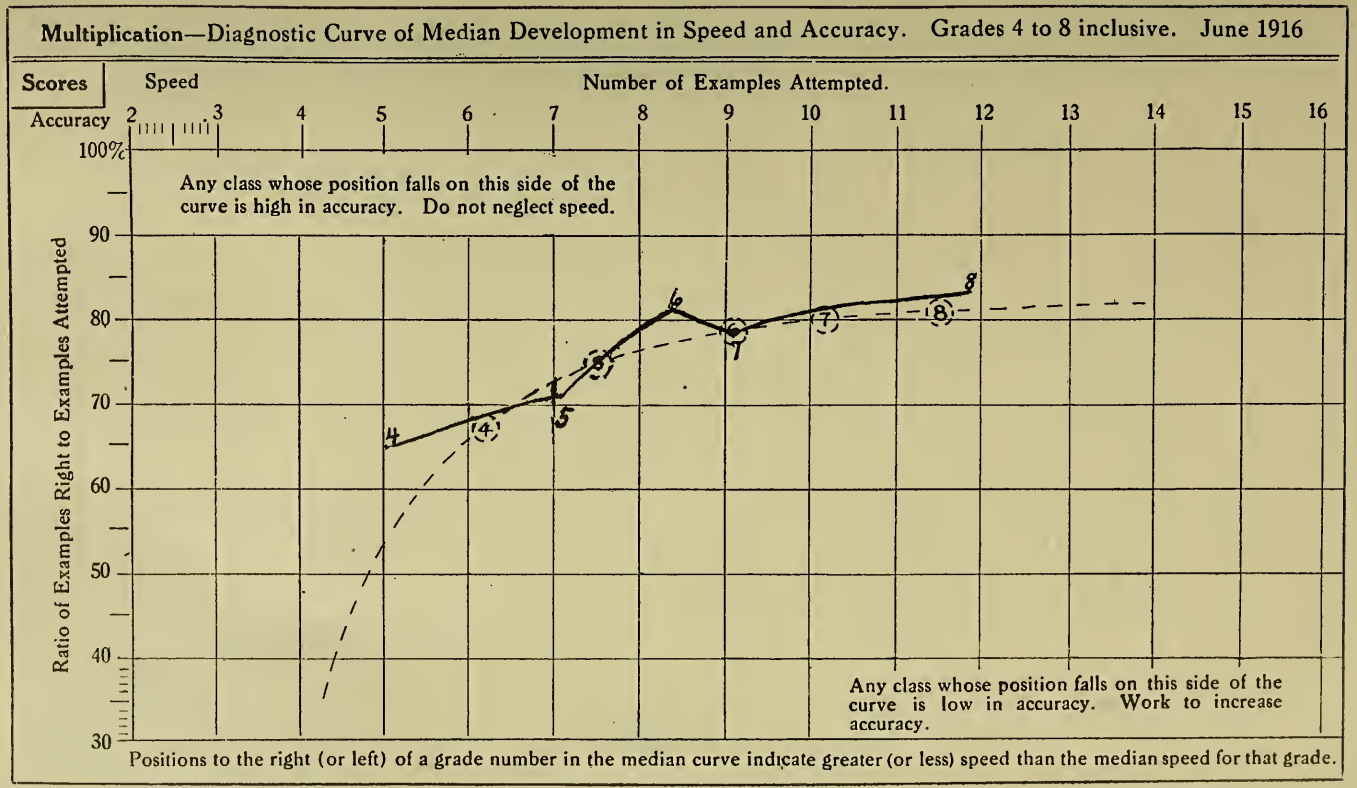
From these tables and graphs any school or grade may be compared with any other school or grade. The test papers are all preserved and any principal or teacher may secure those in which he is interested for the purpose of studying the comparative ability of individual pupils, and also using them as the basis for a study of individual and group progress. The committee hopes that the report on this series of tests may help toward making instruction in the Berkeley schools more balanced as well as more effective. It will be noted that all of the grades, with the exception of the eighth, are below the standard in rights in all processes except subtraction, while the eighth grade rises well above in all but addition. Another noticeable feature is the drop in the seventh grade in all processes except subtraction. In several instances the B division of a grade scored higher than the A division. Standard rights means simply what the pupils in general "on the average" now do. Due to the shortened terms and consequent changes in the course of study, division was omitted by most fourth


Addition—Diagnostic Curve of Median Development in Speed and Accuracy. Grades 4 to 8 inclusive. June 1916
Scores
Speed
Number of Examples Attempted.
Accuracy
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
100%
90
80
70
60
50
40
30
Ratio of Examples Right to Examples Attempted
Any class whose position falls on this side of the curve is high in accuracy. Do not neglect speed.
Any class whose position falls on this side of the curve is low in accuracy. Work to increase accuracy.
Positions to the right (or left) of a grade number in the median curve indicate greater (or less) speed than the median speed for that grade.
Courtis Standard Research Tests Arithmetic Series B

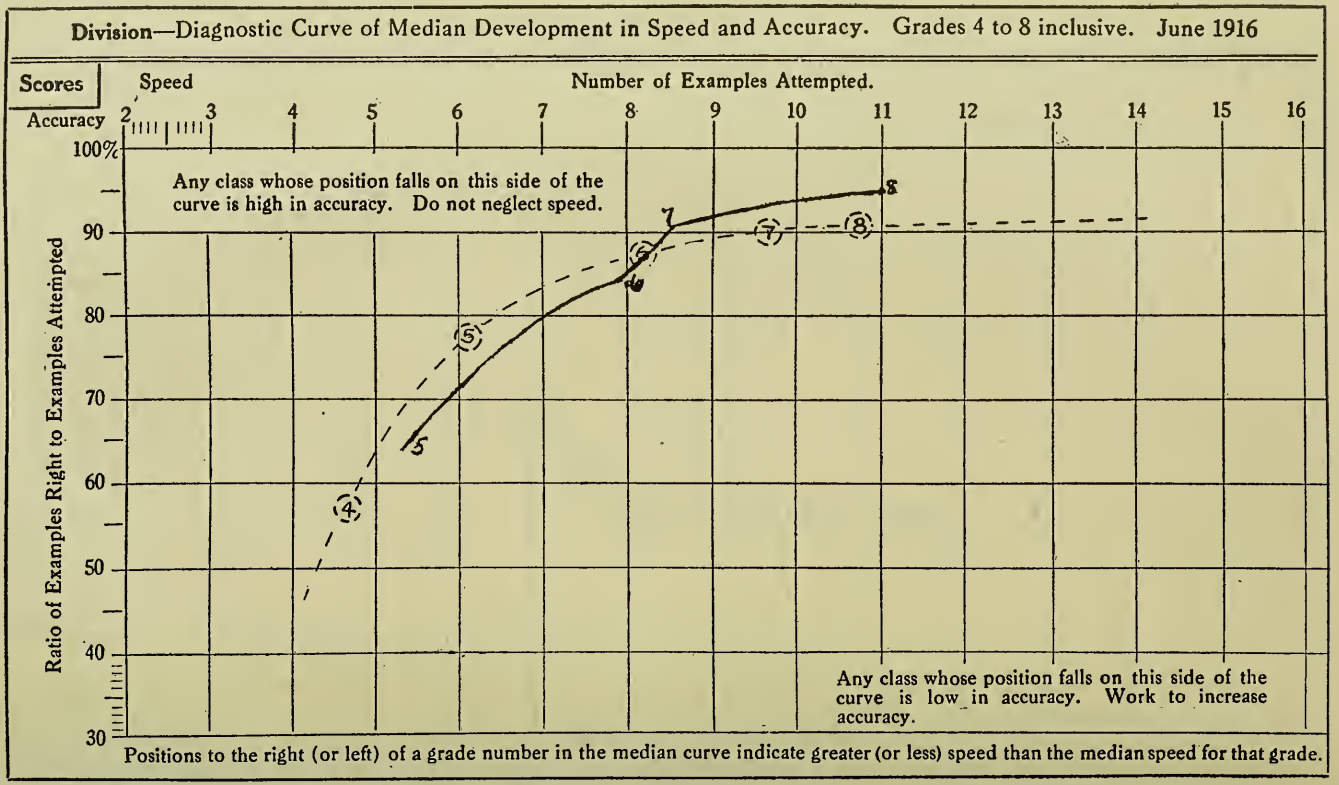
GRAPH I


Subtraction—Diagnostic Curve of Median Development in Speed and Accuracy. Grades 4 to 8 inclusive June 1916
Scores
Speed
Number of Examples Attempted.
Accuracy
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
100%
90
80
70
60
50
40
30
Ratio of Examples Right to Examples Attempted
Any class whose position falls on this side of the curve is high in accuracy. Do not neglect speed.
Any class whose position falls on this side of the curve is low in accuracy. Work to increase accuracy.
Positions to the right (or left) of a grade number in the median curve indicate greater (or less) speed than the median speed for that grade.
Courtis Standard Research Tests Arithmetic Series B

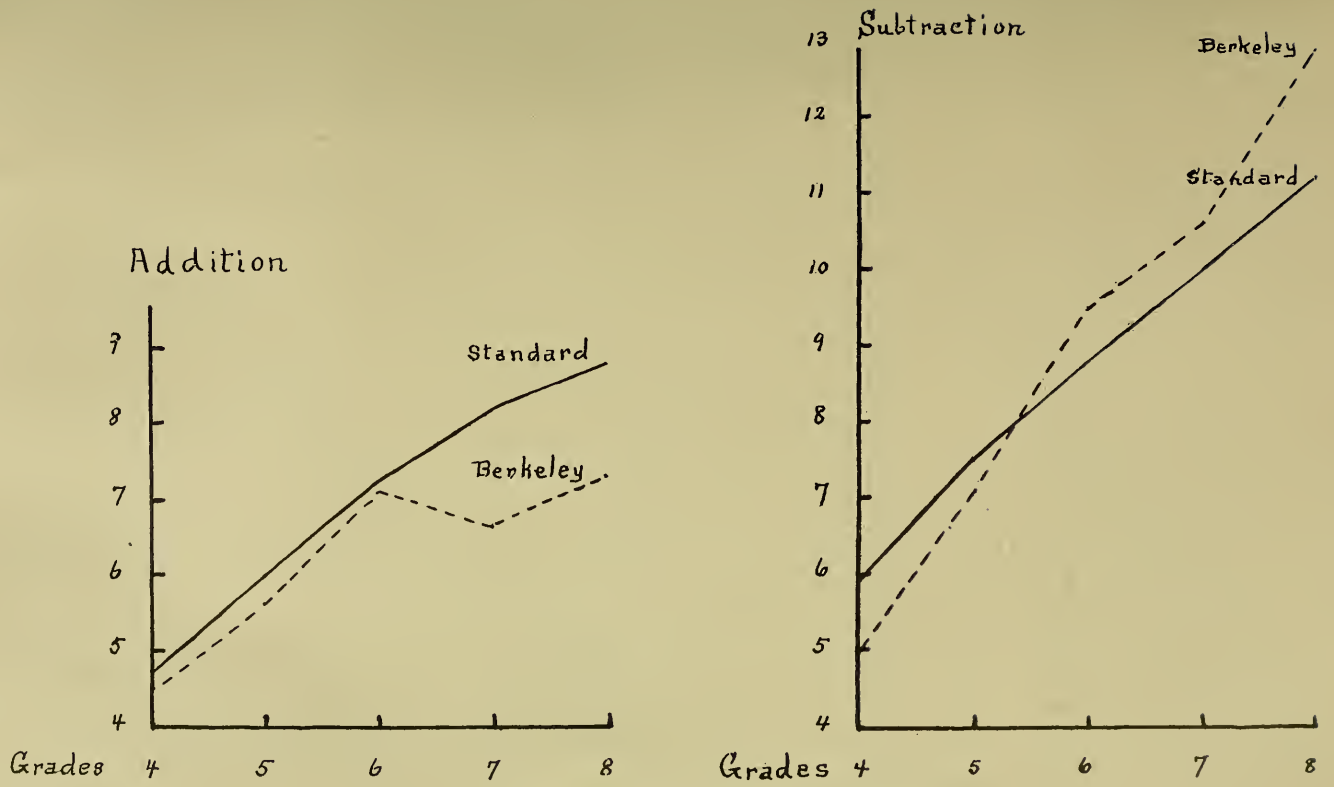
GRAPH II


Multiplication—Diagnostic Curve of Median Development in Speed and Accuracy. Grades 4 to 8 inclusive. June 1916
Scores
Speed
Number of Examples Attempted.
Accuracy
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
100%
90
80
70
60
50
40
30
Ratio of Examples Right to Examples Attempted
Any class whose position falls on this side of the curve is high in accuracy. Do not neglect speed.
Any class whose position falls on this side of the curve is low in accuracy. Work to increase accuracy.
Positions to the right (or left) of a grade number in the median curve indicate greater (or less) speed than the median speed for that grade.
Courtis Standard Research Tests Arithmetic Series B

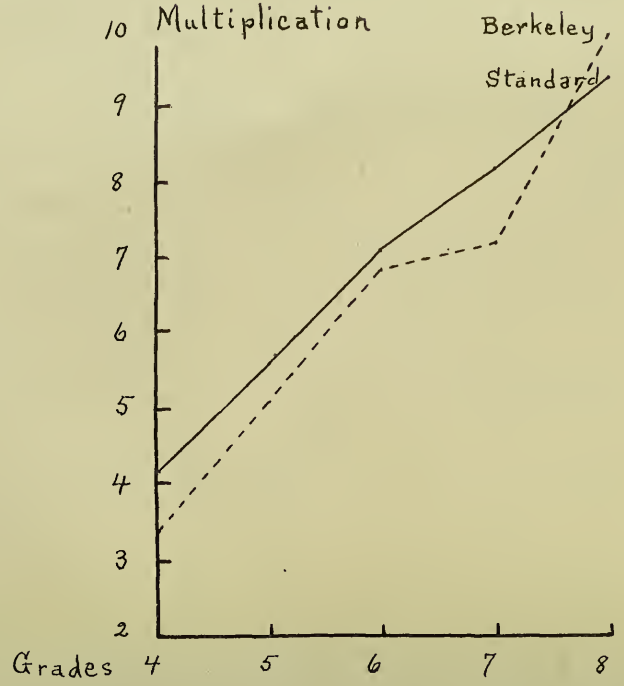
GRAPH III

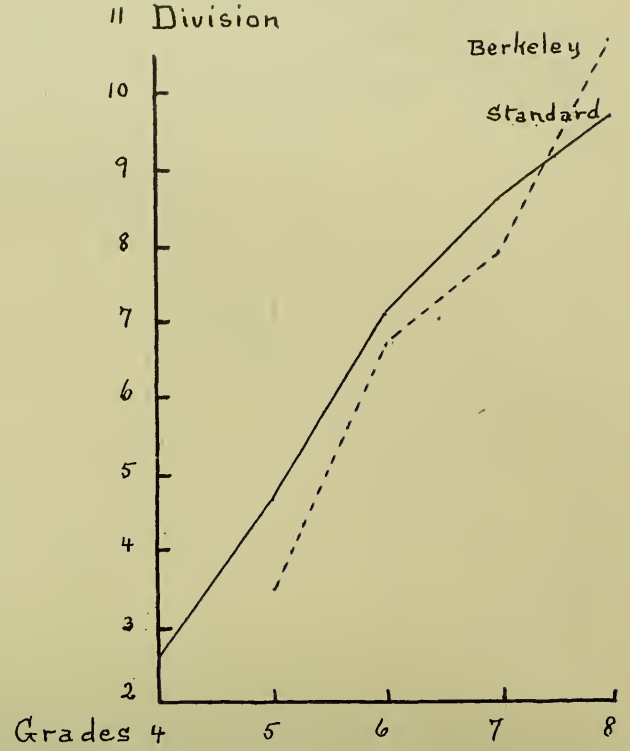

Division—Diagnostic Curve of Median Development in Speed and Accuracy. Grades 4 to 8 inclusive. June 1916
Scores
Speed
Number of Examples Attempted.
Accuracy
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
100%
90
80
70
60
50
40
30
Ratio of Examples Right to Examples Attempted
Any class whose position falls on this side of the curve is high in accuracy. Do not neglect speed.
Any class whose position falls on this side of the curve is low in accuracy. Work to increase accuracy.
Positions to the right (or left) of a grade number in the median curve indicate greater (or less) speed than the median speed for that grade.
Courtis Standard Research Tests Arithmetic Series B

GRAPH IV



Graph of Rights. Graphs V and VI.

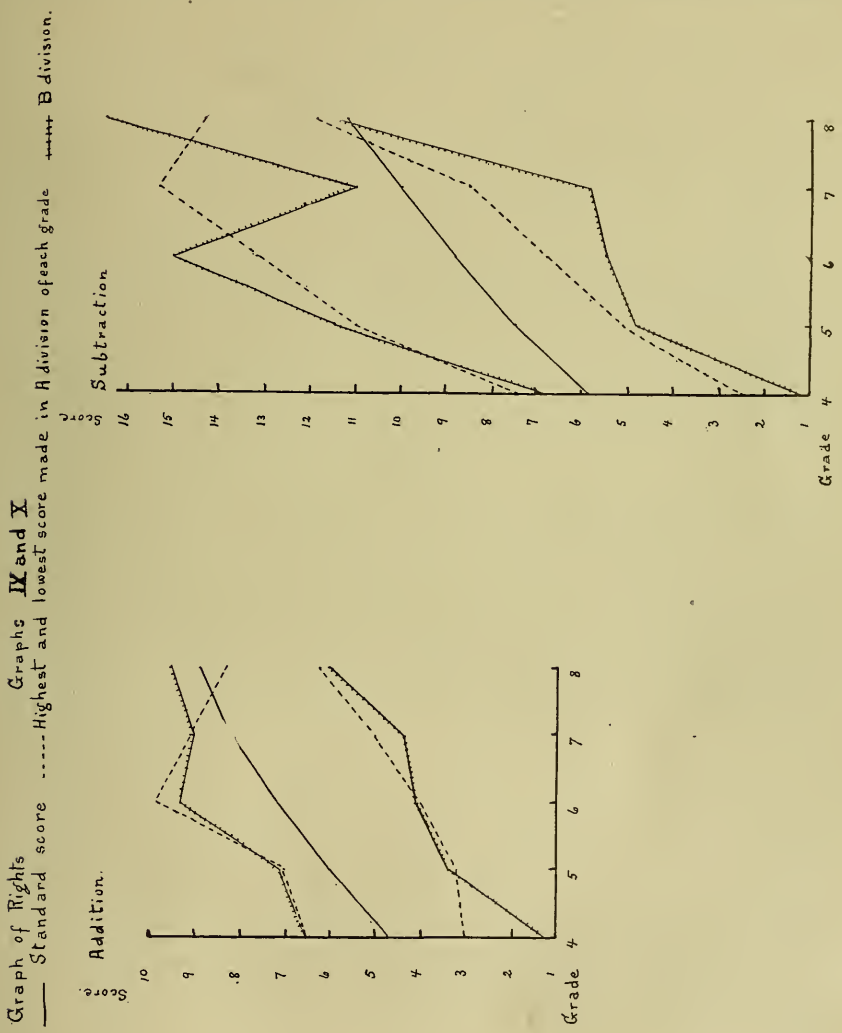




Graph of Rights. Graphs VII and VIII.

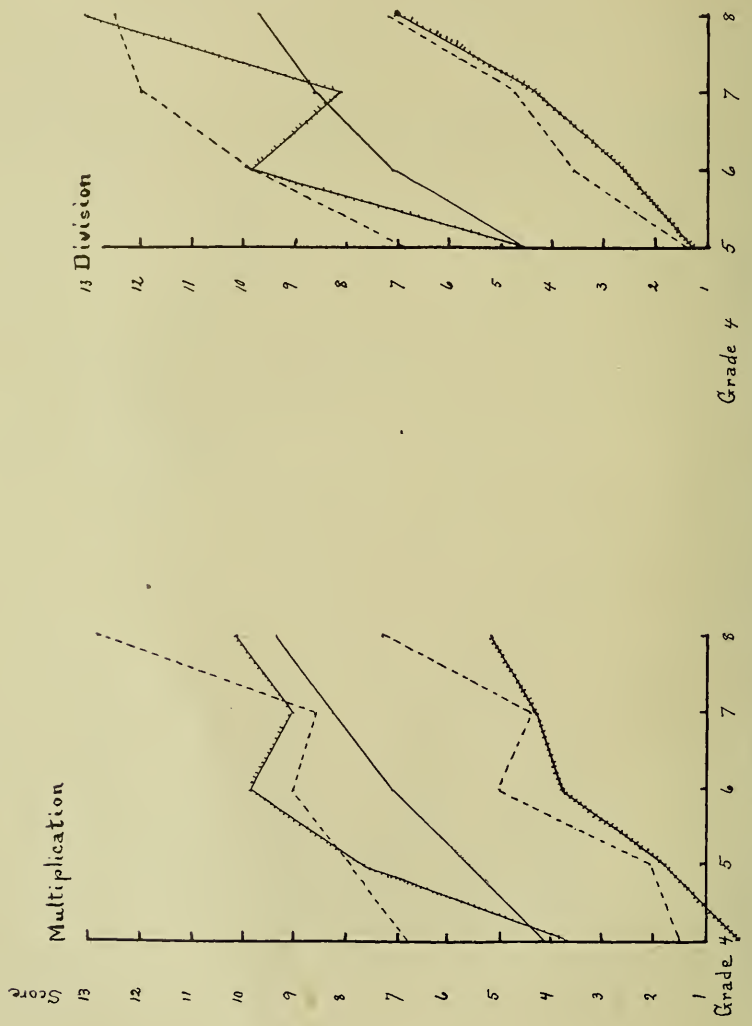
grade classes, so no record was made of the results where these tests were given in the fourth grade.

Attention is called to the fact that the Courtis Standards are based on tests given to both A and B divisions of the grades in May or June. This would mean that the B divisions took the tests about the seventeenth or eighteenth week of its time in the grade, while the A divisions had practically completed the same grade, making the average time in the grade about twenty-seven weeks. The Berkeley tests were given during the twenty-fifth week in the grade for the A classes. Therefore



for our graphs and charts only the scores of our A divisions have been considered and the results are, for approximate purposes, comparable.

Results differ largely in different sections of the city. This may be due partly to the fact that, because the course of study does not call for any definite amount of time to be spent in drilling upon the fundamental processes of arithmetic, there has been no uniformity of practice in the various schools. The drop in the seventh grades probably is due to the fact that at this grade the Junior High organization for all pupils is begun in the Berkeley schools and the change of schools necessarily causes a break in some of the work.



Graph of Rights. Graphs XI and XII. ——— Standard score. – – – – –
Highest and lowest score made in A division of each grade. ⊣⊢⊣⊢⊣ B division.

Several unavoidable factors entered into the Berkeley survey which should be held in mind when results are compared with standards. The two most important, probably, were:

1. Various Red Cross, loan and other war and reconstruction activities which had a patriotic claim upon considerable of the pupils' time.

2. The influenza epidemic. The schools were closed for a total of nine weeks, in two periods, on account of this scourge. Besides this enforced vacation, the attendance of pupils was extremely irregular for weeks, many substitute teachers were employed and there was a noticeable impairment of health of both pupils and teachers.

Recommendations for Berkeley

Each principal should compare his school with other schools, with the Berkeley averages, and especially with the standards, that he may learn where help or better work is needed. Each teacher from her comparisons should be able to derive satisfaction or ambition and determination.

Sufficient practice material should be provided and drill upon the fundamentals required, the required time to depend upon the varying needs as shown by repetition of the tests. Good practice material provides for time limited, motivated work, and pupils are expected to become more proficient in the formal phases of number work in less time than formerly so that a longer time might be devoted to the concrete and applied phases of arithmetic.

The Series B tests should be repeated during both terms of the coming school year, and the results again compiled and made available for all the teachers and principals for further comparisons.

In conclusion, we would refer the teachers of all grades to the very constructive report on the teaching of arithmetic made by the Committee on the Economy of Time in Education in the Eighteenth Yearbook, Part II, of the National Society for the Study of Education, pages 78 to 92.

CHAPTER V

REPORT OF COMMITTEE ON ARITHMETICAL REASONING

Giving the Tests

The Arithmetical Scale A of Starch (Arithmetical Reasoning) was given in the Berkeley Schools on the first day of May, 1919, in all of the grades from the high third to and including the high eighth. The following instructions were sent to the principals of the fifteenth elementary and the four intermediate schools:

THE PUBLIC SCHOOLS
Berkeley, California

Bulletin No. 52.
April 28, 1919.

Directions for Giving Tests in Arithmetical Problems

To Principals and Teachers:

The test in Arithmetical Problems will be given to classes from the third to the eighth grades inclusive during Thursday afternoon, May 1st. A representative of Professor Mead's Seminar will be at your school some time during the morning, at a time which may be arranged by telephone, in order to distribute the material and assist the teachers in interpreting the directions for giving and scoring the test. See that the directions are followed implicitly. Principals will please make the necessary arrangements for the representative to meet the teachers in group.

Directions for Administering and Scoring the Test

Allow the pupils as much time as they need to do as many of the problems as they can. A pupil's score is the number of the highest *step* passed (not the sum of the steps), minus any *steps* on which he may have failed. For example, if a pupil does all steps up to and including 8 and then fails on all the rest, his score is 8. But if he fails on 9, does 10 and 11, and fails on the rest, his score is 10. That is, he receives credit for every step passed beyond the point where he first failed and is penalized for every step on which he failed.

The results for a class should be tabulated to show the name of each pupil together with his score and the average for the entire class.

Before beginning the test have each pupil fill in the data asked for at the bottom of the test sheet. When all have finished, tabulate the class results as by the above directions, include such tabulation in the test sheets, tie all into a compact bundle and hand to the Principal, who will send same to the Superintendent's office by 4 o'clock the following day.

Very truly yours,

H. B. Wilson,
Superintendent of Schools.

On the day preceding the giving of the tests each school was visited by a member of the Seminar, who instructed the teachers in reference to givinng and scoring the tests. These following oral instructions supplemented the printed ones:

1. 20 or 30 minutes should be sufficient for the test. At the end of 30 minutes collect all papers. Allow at least a 30-minute period exclusive of the time for the data at the bottom of the sheet. Tell the children to take the time they need and that all do not need to start and stop at the same time.
2. Tell the children to use the back of the sheet for scratch paper. They are to work mentally if they wish and to use *pencil.*
3. The results of each test should be entered on a blank sheet of paper. Write each pupil's name and score. Add and average. Return all unused sheets.
4. Mark each problem correct with a C. Count the number of Cs. Count down that number of problems and the last number is the score. Disregard the score in parenthesis.
5. Proceed with your regular arithmetic for the morning, but do not touch on problems of this nature.
6. Give at the same period throughout the building, either all before or all after an intermission.

The tests were given and scored by the teachers, whose work was verified by Seminar members. The results are shown in the accompanying tabulations and graphs.

Comparison of Facts from Study of Tables and Graphs

Table I shows the grade distribution of scores assembled irrespective of schools, the total number of pupils in each grade, and the average score made. Thus, in the A3 grade of the Berkeley schools there were 353 pupils. The average score attained by this grade was 4.2.

TABLE I—DISTRIBUTION OF SCORES ACCORDING TO "STEPS ATTAINED" BY THE VARIOUS GRADES, 3A TO 8A INCLUSIVE

SCORE	3A	4B	4A	5B	5A	6B	6A	7B	7A	8B	8A
0	8	1	3	2		1				1	
1	74	49	30	12	6	2	1		1		
4	146	130	105	53	41	22	6	1	4		
6	66	98	128	83	75	47	23	16	15	6	1
7	42	40	82	107	103	67	49	22	22	11	2
8	15	34	57	62	83	87	67	38	33	23	10
9	2	7	22	36	58	66	85	61	55	24	26
10		2	5	15	37	51	72	45	74	34	32
11			3	6	8	28	58	58	68	46	65
12					6	9	35	39	79	41	60
13				1		4	17	29	48	60	64
14						1	4	18	33	28	56
15							1	6	14	6	39
Number	353	361	435	377	417	385	418	333	446	280	355
Average	4.2	5.0	5.8	6.7	7.3	8.1	9.3	10.1	10.7	11.1	12.1

Table II shows the class averages for all of the grades in all of the elementary and intermediate schools of Berkeley. This total class average (A divisions) is compared to the Starch standard for the same grades. Thus, the A3 grades in the Berkeley school attained a score of 4.2, while the Starch standard presumably for the A3 grade is 4.6.

Table III assembles the averages of the High divisions of each grade and compares them to the Starch standards. These are used as a basis for the graph which pictures the attainment of the Berkeley schools in relation to the Starch standards. (Graph I.)

A review of the table and graph showing the achievement of the Berkeley schools in the Starch test discloses the fact that the Berkeley score is consistently lower than the standard. It must be remembered that, as in the fundamentals, the standard score is given only for the end of each year; therefore there is no means of comparison in the low divisions.

In a study of the tables, one observes that the schools having a large foreign-speaking element average below the standards in the reasoning test, while in the "fundamentals," with one exception, they average above. This may be expected, as in problem work so much depends upon the reading ability of the child. On the other hand, in those schools where the children are accustomed to home reading and have a ready understanding of the printed paragraph, the scores made

TABLE II

	H. 3rd	L. 4th	H. 4th	L. 5th	H. 5th	L. 6th	H. 6th	L. 7th	H. 7th	L. 8th	H. 8th
Columbus	4.1	4.8	5.5	6.3	5.9	6.9	8.9				
Emerson	4.9	5.9	7.5	7.3	7.6	8.1	10.2				
Franklin	4.1	3.9	5	5.5	7.8	7.2	8				
Hawthorne	5.2	4.8	4.7	6.6	7	7.6	7.9				
Hillside	5.2	5.6	6.9	7.9	7.6						
Jefferson	4.8	4	6	6.3	7	7.4	9				
John Muir	5.3	5.5	6.2	7.5	7.1	8.8	9.8				
LeConte	4.8	5.4	6.4	6.3	7.3	8.7	9.6				
Lincoln	3.3	4.6	5.6	7.5	7	9	9.6				
Longfellow	4.4	4.3	5.5	6.6	7.5	6.7	9.2				
McLinley	6.6		5.6	6.6	8.1	8.2	8.9				
Oxford	3.8	5.3	4.6	7.1	6	8.7	9.3				
Thousand Oaks	2.5	4.4	5.8	7.7		7.4					
Washington	3.3	5.6	5.9	6.4	8.1	8.7	10.4				
Whittier	3.5	5	5.5	6.1	7.2	8.2	8.8				
Average*	4.2	5.0	5.8	6.7	7.3	8.1	9.3				
Starch Standard	4.6		6.2		7.8		9.4				
Burbank								9	9.4	10.6	11.3
Edison								11.3	10.8	10.8	12.3
Garfield								9.9	10.9	11.9	12
Willard								9.9	11.3	11.6	12.3
Average* for Berkeley								10.1	10.7	11.1	12.1
Starch Standard									11		12.6

*These averages are from the total distributions, not averages of school classes.

in the reasoning test were above standard, while many fell below in the fundamentals. The fact that the sixth grades, marking the end of the elementary schools, approach the standard in both the fundamentals and the reasoning tests, while the seventh grades show a drop, may be due to the change of schools at this point and consequent change of systems.

Table III

Berkeley Score (A. Division of grades)	Starch Standard
Grade 3— 4.2	4.6
Grade 4— 5.8	6.2
Grade 5— 7.3	7.8
Grade 6— 9.3	9.4
Grade 7—10.7	11.0
Grade 8—12.1	12.6

Graph I—Starch-Scale A. Reasoning Test. Berkeley Score compared with Starch Standard.

Recommendations

It is the sentiment of the committee that there is not enough available problem work related to the child's experience, especially in the elementary grades. This has a tendency to emphasize the mechanical side of the work and does not afford opportunity for the exercise of the reasoning ability. So far as is feasible number work should be drawn from or related to real concrete situations. The child should also have access to a quantity of interesting and varied material such as would continually challenge his intellectual activity and stimulate independent thinking. To this end the committee recommends that there be placed in the hands of the children the best of modern and up-to-date texts. The problems and exercises in these books deal with facts related to actual experience and would give the child an opportunity to think and work independently. The teacher is urged to supplement the texts with real community problem material.

The committee recommends that a copy of the tables and graphs be placed in each school for the purpose of study. Teachers are referred to the 18th Year Book of the National Society for practical and helpful suggestions.

APPENDIX

ENGLISH COMPOSITION AND GEOGRAPHY

The tests in English composition and geography were organized, given, scored and tabled by the 1920–21 Educational Measurements Seminar.[2] The Nassau County Supplement to the Hillegas Scale was used in composition. Typical schools representative of the city were chosen with a sum total of nearly 1200 pupils. The tests were given about February 18, 1921. The midyear promotions had taken place and the B or low classes were some five weeks "over the grade," i.e., they were beginning the work of new grades. For purposes of comparison, however, they were considered as finishing the grade previous. The B or low sections only were tested. The results were compared with the end of the year standards for the grade preceding. This meant that the Berkeley pupils had some five weeks the advantage. Tables I and II give the distribution of scores in composition for the classes tested in each school. Table III assembles the totals for the city. These data are pictured in the chart.

The following was the procedure in giving the composition tests:

Instructions to be Followed in Giving the Composition Test

Provide each pupil with a sheet of the paper usually employed for composition work. Have them use pen and ink, unless they are accustomed to writing compositions with pencils. Direct the children to write at the top of the page their names, ages, grade, school, city and date, with a statement of about the number of weeks each one has been in the grade. Then make the following explanation: "I want to find out how interesting a story you can write when you try your very best. You may write on both sides of the paper if you wish. I want you to write this story in your best handwriting, to use the best English you can write, and above all to make the story as interesting as possible. I want you to tell me what you would like to do next Saturday. 'What I Should Like to Do Next Saturday' is the topic on which you are to write. You may now go to work. Let us see how well you can write."

[2] Florence L. Andruss, Edna L. Dessery, William V. Emery, Ruth S. Genung, Frances Giddings, Rose E. Hollstein, Thurston P. Knudson, Zing Yang Kuo, Charles B. Leonard, Eugenie Andruss Leonard, Florence E. Luke, Beverly M. Nevison, Loretta Munro Parkinson. Credit is due also to Miss Marion C. Smith, Assistant in Research in Berkeley, for coöperation and assistance.

TABLE I—DISTRIBUTION OF SCORES IN ENGLISH COMPOSITION—NASSAU COUNTY SCALE

SCALE VALUES NASSAU COUNTY SUPPLEMENT	Emerson	Franklin	5B Grade (means 4A) Hawthorne	Hillside	Jefferson	Longfellow	Oxford	Thousand Oaks	Washington	Total Pupils
.0 (0 0.53)		5		1		2				8
1.1 (0.54-1.49)						1				1
1.9 (1.50-2.36)				1	1	3				5
2.8 (2.37-3.32)	3	20	7	20	8	4	5	1	7	75
3.8 (3.33-4.40)	27	6	3	14	4	4	16	12	29	115
5.0 (4.41-5.48)	1							1	2	4
6.0 (5.49-6.61)								1		1
7.2 (6.62-7.61)										
8.0 (7.62-8.50)										
9.0 (8.5-up)										
Total in Class	31	31	10	36	13	14	21	15	38	209
Median counted	3.7	2.8	3.2	2.8	3.2	2.8	3.4	3.8	3.7	3.26
Median calculated	3.85	2.89	3.05	3.15	3.08	2.7	3.73	3.915	3.716	3.34
Average	3.74	2.51	3.1	3.08	3.04	2.3	3.56	3.9	3.678	3.21
Standard	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Percent of class at or above standard	68	19	20	39	31	27	47	86	76	46
			6B	Grade	(means	5A)				
.0 (.0 -0.53)								1		1
1.1 (0.54-1.49)										
1.9 (1.50-2.36)								2		2
2.8 (2.37-3.32)	14	10	2	4	2		1	2	7	42
3.8 (3.33-4.40)	18	10	6	7	13	10	3	14	23	104
5.0 (4.41-5.48)	2		2	7		6	14	4	17	52
6.0 (5.49-6.61)	1					1			6	8
7.2 (6.62-7.61)										
8.0 (7.62-8.50)										
9.0 (8.5-up)										
Total in Class	35	20	10	18	15	17	18	23	53	209
Median counted	3.45	3.15	3.85	4.15	3.65	4.40	4.7	3.8	4.1	3.91
Median calculated	3.57	3.33	3.87	4.10	3.82	4.20	4.83	3.86	4.24	3.98
Average	3.53	3.0	3.84	4.04	3.66	4.30	4.68	3.59	4.10	3.94
Standard	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Percent of class at or above standard	22	0	40	55	6	64	89	16	50	38.8

TABLE II—DISTRIBUTION OF SCORES IN ENGLISH COMPOSITION—NASSAU COUNTY SCALE

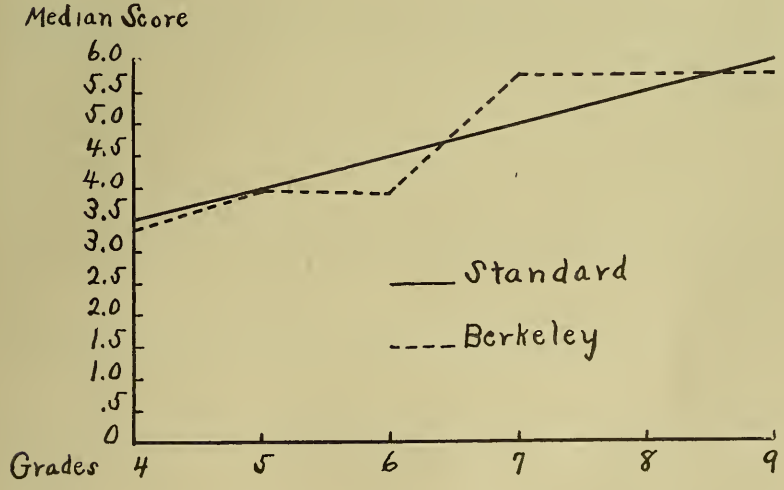
Scale Values Nassau Co. Supplement	7B Grade (Means 6A)				8B Grade (Means 7A)				9B (Means 8A)			10B (9A)
	Edison[1]	Edison[2]	Willard	Total Pupils	Edison[1]	Frances Willard[1]	Frances Willard[2]	Total Pupils	Edison	Willard	Total Pupils	Berkeley High Sch. Total Pupils
0 (0-0.53)		8	2	10								
1.1 (0.54-1.49)			1	1								
1.9 (1.50-2.36)			5	5								
2.8 (2.37-3.32)	4	10	9	23								3
3.8 (3.33-4.40)	29	33	48	110	15	1	1	17	3	2	5	19
5.0 (4.41-5.48)	21	8	30	59	43	6	6	55	33	15	48	55
6.0 (5.49-6.61)	1		5	6	34	50	29	113	23	46	69	61
7.2 (6.62-7.61)						2	1	3	6	24	30	46
8.0 (7.62-8.50)									1		1	
9.0 (8.5-up)												
Total in Class	55	59	100	214	92	59	37	188	66	87	153	184
Median counted	3.8	3.8	3.8	3.8	5.5	5.9	5.9	5.7	5.00	6.00	5.50	5.5
Median(calculated)	4.2	3.72	4.07	3.88	5.18	6.01	5.95	5.71	5.38	6.14	5.76	5.75
Average	4.22	3.28	3.98	3.82	5.17	5.90	5.81	5.62	5.58	6.11	5.84	5.09
Standard	4.50	4.50	4.50	4.50	5.0	5.0	5.0	5.0	5.5	5.5	5.5	6.0
Percent of class at or above standard	41.8	14	35	30.2	83.6	97	92	90.8	45	79	62	58

TABLE III—DISTRIBUTION OF SCORES IN ENGLISH COMPOSITION—NASSAU COUNTY SCALE

Berkeley Elementary and Intermediate Schools

SCALE VALUES—NASSAU CO. SUPPLEMENT	5B 4a	6B 5a	7B 6a	8B 7a	9B 8a	10B 9a	Total	Pct.
.0 (0. -0.53)	8	1	10				19	1.64
1.1 (0.54-1.49)	1		1				2	.17
1.9 (1.50-2.36)	5	2	5				12	1.04
2.8 (2.37-3.32)	75	42	23			3	143	12.36
3.8 (3.33-4.40)	115	104	110	17	5	19	370	31.98
5.0 (4.41-5.48)	4	52	59	55	48	55	273	23.59
6.0 (5.49-6.61)	1	8	6	113	69	61	258	22.30
7.2 (6.62-7.61)				3	30	46	79	6.83
8.0 (7.62-8.50)					1		1	.09
9.0 (8.5-up)								.00
Total	209	209	214	188	153	184	1157	100.00

NOTE.—5B is considered as 4A since the test was given five weeks after promotion, therefore work of 5B is compared with standard of 4th grade.



Scores in English Composition—Tables I-III

Nassau County Scale

With young children the topic should be written on the board after the above oral explantaion has been made. For the ninth and tenth year classes the topic should be, "What I Should Like to Do After I Leave High School." The directions are to be the same in other respects. At the end of 18 minutes have the pupils hand in their papers, with the assurance that each one has at least written enough to enable us to determine whether or not he is going to have a good time on Saturday, etc.

GEOGRAPHY

Questons of 73 per cent end-of-the-year difficulty were selected from the Hahn-Lackey Scale for Measuring Ability of Children in Geography. An effort was made to divide the questions equally between the factual and the more thought provoking. These questions were mimeographed, space being allowed for answers, and the forms distributed to the pupils. An illustration of the Grade Low 5 test is given. Attention is again called to the fact, for reasons previously noted, that, while this particular test was given to a Low 5 grade, the questions were from the fourth grade end-of-the-year 73 per cent column. The class average, in other words, should approximate 73 per cent with pupils finishing the grade. Tables I and II give the distribution of scores in geography for the classes tested in each school. Table III assembles the totals for the city. These data are pictured in the chart.

Name..... Age (last birthday) ..... Grade .....

School ..... City ..... Date .....

State about how many weeks you have been in this grade. About ..... weeks

A Test in Geography for Grade Low 5

1. What country is north of the United States and to whom does it belong?

2. What two oceans border on the United States?

3. Name five wild animals.

4. Name two other countries in North America besides the United States.

5. Name two kinds of work that men do in getting materials for building houses.

6. Name two kinds of work that men do in getting food for us.

7. How can you tell from what direction the wind is blowing?

8. To whom do the streets or roads belong?

Instructions to be Read to Pupils Taking the Geography Test

I am going to pass some questions in geography which I shall ask each of you to try to answer. You will be given enough time for this. Write the best answer you can in the fewest words just under the proper question. Complete sentences are not necessary; words or phrases will do. You should use a pencil for your work. You are not expected to be able to answer all the exercises. Some of them were made difficult on purpose; but if you can answer the difficult ones, the credit due you will be that much greater. At any rate, try hard to answer every exercise. You are to ask no questions about any of the exercises in the test. If I should permit you to ask questions and then answer them for you, it would defeat the purpose of the test and your answers could not be used.

After the papers are passed to you, I shall read each question clearly so that you may understand the wording. You are then to begin. When you have finished bring your paper to the desk.

(Have papers passed. Have pupils fill blanks at top of form, then read clearly once with all attending. Start pupils to work. Do not impose a time limit, but 30 minutes should be ample time. As the papers come in, enter the time taken on each, to the nearest five minutes, and any other data which might be of interest.)

TABLE I—DISTRIBUTION OF SCORES—GEOGRAPHY (HAHN-LACKEY SCALE)

Percent Values of Scale	Low 5 Grade (means High 4)										Low 6 Grade (means High 5)									
	Emerson	Franklin	Hawthorne	Hillside	Jefferson	Longfellow	Oxford	Thousand Oaks	Washington	TOTAL	Emerson	Franklin	Hawthorne	Hillside	Jefferson	Longfellow	Oxford	Thousand Oaks	Washington	TOTAL
0																				
1																				
2																				
4(3-4)																				
6(5-6)												1							4	5
8(7-9)																1				1
12(10-13)		1	1							2		2							3	5
16(14-18)		1	1			1				3		1	1					1		3
21(19-23)																				
27(24-30)	1									1		3	1		2	2		2	3	13
34(31-37)		3		1	2				4	10		3		1	1	2	2	1	7	17
42(38-45)	1	2	4		1	3	3	4	5	23	3	2	5	2	1	1	3	1	3	21
50(46-54)	2	3	3		2	1	1	1	2	15	3	3	2	2	6	2		3	6	27
58(55-62)	5	6		5	2	5	3	4	7	37	5	4		1		2	4	5	12	33
66(63-69)		3	1	5		1	6	2	7	25	2	1			2	2		1	7	15
73(70-76)	5	5		3	1	1	2		3	20	3			2	1			2	5	13
79(77-81)	2	2		2		1	2	3	4	16	2		2	3	1	1		2		11
84(82-86)		2					3		1	6							2	1	3	6
88(87-90)	6				3	2		1		12	3				1	1		3		8
92(91-93)	3			6	1				3	13				5	1	1	2	1		10
94(94-95)											4									4
96(96-97)											1									1
98																				
99																				
100		1		2	1		2		1	7	3	1		2		1	2		3	12
Tl. Class	25	29	10	24	13	15	22	15	37	190	29	21	11	18	16	16	15	23	56	205
Average	71.44	65.41	41.2	78.46	65.7	58.4	59.68	60.46	62.33	63.84	72.07	40.55	46.46	73.28	55.25	53.06	65.2	60.69	51.43	57.65
Pct. of class at or above 73% standard	64.0	34.5	0	54.1	46.1	26.6	40.9	26.6	32.4		44.8	4.76	18.8	66.67	25.0	25.0	40.0	39.1	19.64	

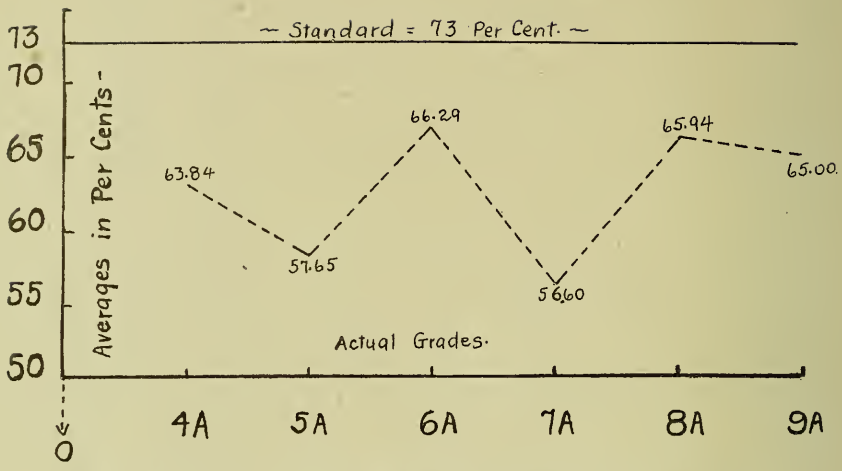
TABLE II—DISTRIBUTION OF SCORES—GEOGRAPHY (HAHN-LACKEY SCALE)

Percent Values of Scale	Grade Low 7 Means High 6)			Grade Low 8 (Mns) High 7	Grade Low 9 (Means High 8)			BERKELEY HIGH SCHOOL Grade Low 10 (Means High 9)					
	Edison School Junior High	Frances Willard Junior High	TOTAL	Edison School TOTAL	Edison School Junior High	Frances Willard Junior High	TOTAL	7 Min.	9 Min.	10 Min.	11 Min.	12 Min.	TOTAL
0													
1													
2													
4 (3-4)													
6 (5-6)								1					1
8 (7-9)													
12 (10-13)				4								1	1
16 (14-18)	2		2			2	2						
21 (19-23)				1		2	2						
27 (24-30)		2	2	1	2	4	6	1		1		1	3
34 (31-37)	5	4	9	16	9	11	20	1	1	3	4	3	12
42 (38-45)	6	11	17	10	6	13	19	1		2		2	5
50 (46-54)	7	10	17	10	5	26	31	2		6	3	7	18
58 (55-62)	25	11	36	18	12	50	62	3	3	7	3	18	34
66 (63-69)	14	21	35	10	11	29	40	2	1	7	3	6	19
73 (70-76)	13	12	25	9	8	30	38	3	2	3	4	3	15
79 (77-81)	11	7	18	8	11	10	21	1	1	3	1	1	7
84 (82-86)		4	4			4	4						
88 (87-90)	15	8	23	3	5	16	21	2	2	9	2	3	18
92 (91-93)	10	3	13		3	7	10	1	1	5	3		10
94 (94-95)													
96 (96-97)				5		1	1						
98						1	1						
99													
100	4	1	5	2	2	1	3	2				1	3
Total in Class	112	94	206	97	74	207	281	20	11	46	23	46	146
Average	68.2	64.05	66.29	56.6	62.9	62.21	65.94	65	71	68	66	59	65
Percent of Class at or above 73% standard	47.3	37.0		27.8	39.32	34		45	55	43	43	17	36

TABLE III—GEOGRAPHY (HAHN-LACKEY SCALE)

Average Scores of All Grades in Berkeley

Percent Values of Scale	Grade 4A	Grade 5A	Grade 6A	Grade 7A	Grade 8A	Grade 9A	Total
0							
1							
2							
4 (3-4)							
6 (5-6)		5				1	6
8 (7-9)		1					1
12 (10-13)	2	5		4		1	12
16 (14-18)	3	3	2		2		10
21 (19-23)				1	2		3
27 (24-30)	1	13	2	1	6	3	26
34 (31-37)	10	17	9	16	20	12	84
42 (38-45)	23	21	17	10	19	5	95
50 (46-54)	15	27	17	10	31	18	118
58 (55-62)	37	33	36	18	62	34	220
66 (63-69)	25	15	35	10	40	19	144
73 (70-76)	20	13	25	9	38	15	120
79 (77-81)	16	11	18	8	21	7	81
84 (82-86)	6	6	4		4		20
88 (87-90)	12	8	23	3	21	18	85
92 (91-93)	13	10	13		10	10	56
94 (94-95)		4					4
96 (96-97)		1		5	1		7
98					1		1
99							
100	7	12	5	2	3	3	32
Total	190	205	206	97	281	146	1125
Average	63.84	57.65	66.29	56.60	65.94	65.00	



Average scores for respective grades in Berkeley for Geography. Hahn-Lackey Scale.

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